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FORAGE PLANTS

AND

THEIR ECONOMIC CONSERVATION

BY

THE NEW SYSTEM OF "ENSILAGE."

PART I.

Caucasian Brickly Comfrey.

PART II.

BALSAMOCARPON

And other Plants containing Tannin.

BY THOMAS CHRISTY, JUN., F.L.S.



LONDON:

CHRISTY & CO., 155, FENCHURCH STREET, E.C.

1877.

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SOUTHAMPTON







etched from nature July 31st 1876. Produced from a root cutting planted February of same yr. Height 3^{ft} circumference 9ⁱⁿ grown by Mr. H. Doubleday, Coggeshall Rebdon Essex.



*Sketch of blossom
natural size.*



*Section of old Comfrey
showing hollow stem.*



*Section of
new Comfrey
showing solid stem.*



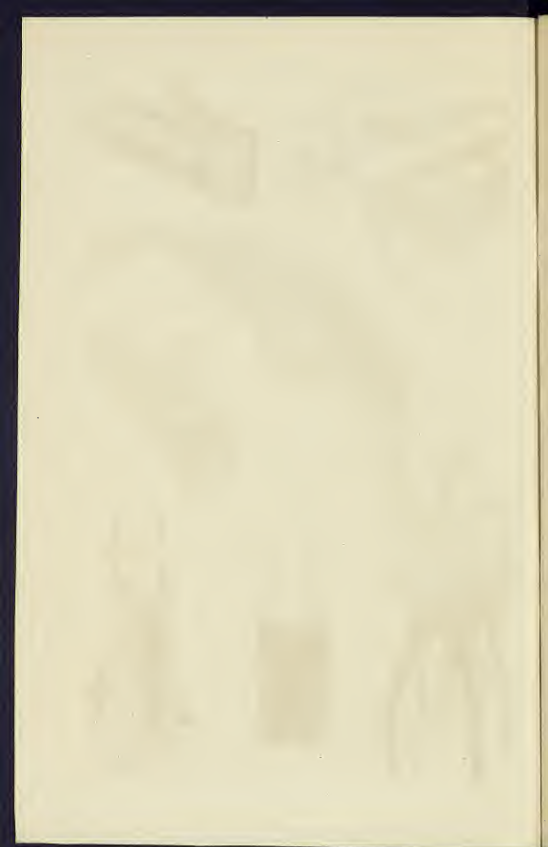
*Sketch showing hollow groove running
from the leaf down the stem to the root.*



Root Cutting.



Crown Cutting.





PREFACE.

The following pages are devoted to a popular exposition of the qualities of certain Forage Plants and Shrubs calculated to prove of the utmost service to Home, Colonial, and Foreign cultivators; as well as to an exposition of the merits of certain Implements and Machinery, essential to the successful application of the system of "*Ensilage*" or pickling Fodder, and which system is fully explained and illustrated.

M. BARRAL, the distinguished French Professor of Agriculture, treating of the virtues of one of the most important of the plants therein described, attributes its valuable qualities to the excess of Azote it contains.

The drawing and description of Balsamocarpon (hitherto unpublished) together with particulars of plants containing Tanning, are of importance to both Tanners and Merchants at home and abroad.

ALFRED SOUTHEY,
STEAM PRINTING WORKS,
14, CULLUM STREET, LONDON, E.C.

The ROYAL MAIL STEAM PACKET COMPANY have granted us special facilities for shipment of our Cases; we are now able to deliver them at all the Company's Brazilian, River Plate and West Indian Ports, on the same terms as to the East Indies, &c.

INTRODUCTION.

The efforts I have been making to demonstrate the importance of *Symphytum asperrium* (better known as Causcasian Prickly Comfrey) as a forage plant, have at last been crowned with success.

Experience may be a slow but it is a sure teacher, especially when the question depends upon *profit and loss*.

Farmers as a class are profoundly conservative, indeed, at times, too conservative, as they frequently perpetuate old methods which have ceased to produce the desired profit. The present bad times require them to be conservative of their own interests rather than of old worn-out methods, such as growing Wheat in hopeless competition with the farmers of California.

England has splendid land for forage crops, and farmers need no longer say "We can't lay down our clay-land with pasture because it won't pay, and we can't afford to wait for the crop."

They must now turn their attention, as merchants do, to what *will pay*.

The merchant telegraphs to one of the great granaries, for cargoes of Wheat, or any other grain, the supply of which he believes will be short, and they arrive quite independently of the caprices of English weather.

Stock always commands a high price, and, therefore, that kind of produce should be grown of which both the straw and the grain will serve equally well for feeding purposes.

There is another aspect of the growth of Comfrey in this country to which I am anxious to call the serious

attention of English agriculturists. They have no idea of the large quantities of adulterated Butter constantly being sent to this country. But these are so considerable that the Government ought to interfere to prevent the importation, which robs the farmer while it poisons the consumer.

The demand for a good wholesome article is so great that every possible means to increase the quantity of native-made Butter ought at once to be adopted.

There is no plant yet discovered which possesses such milk-producing qualities as the *Symphytum Asperinum*. Professor BUCKMAN, in his interesting paper (Page 3), states that it is capable of conferring great benefit on the Farmer.

Being a deeply-rooted plant, it will afford in the hottest and dryest season several heavy cuttings, when all other vegetation is stagnant or dried up.

As soon as the roots have taken hold of the ground, cattle and sheep may at once be turned on, but it will be as well to move them off when the foliage is eaten down, and if flower stems remain they should be cut down. This plan ensures a continuous crop.

I have spared no pains to obtain specimens from all parts of Europe, and some of the varieties sent me by the Director of the Jardin des Plantes at St Petersburg are very fine.

The Solid Stem variety, described by Mr. HENRY DOUBLEDAY (Page 11), will be found to take the place of all others at present known. Common sense shows that a solid stemmed plant must be better for feeding purposes, particularly in a hot climate, than one with a hollow stem. Accordingly, the plant is invaluable for India and the Colonies.

The frequent famines in the East make cultivators there eager to secure every advantage in their struggle with nature. Proof is furnished in these pages that in India and Ceylon this plant flourishes with more than giant magnitude.

The tropical rains give a fertility unparalleled in our

more temperate regions; indeed, a fertility which would be embarrassing to the grower, were it not for the plan, long practised by the Arabs, but almost unknown, or, at least, rarely employed, by ourselves, of "**Ensilage**," *i.e.*, storing forage in a fresh condition for future use.

Farmers need not now depend solely upon the capricious haymaking season. "Make hay while the sun shines" is no doubt excellent advice; but Yorkshiremen and Scotchmen know too well the difficulty of compliance

It will be seen by reference to the observations on this subject at page 30, that in October 1876 fodder gathered while perfectly wet—indeed, during storms of rain—turned out, when opened in December, in first rate condition and quite equal in all respects to that put up in dry weather.

How important then is this system for the East and our Colonies, and all places where the crop is cut in the wet monsoon! Any amount of green fodder can then be secured, the action of fermentation so softening the hard stalks and ends, that even the Guinea Grass will yield to the effect of the lactic acid, and in hot climates a lining to the pits is not necessary.*

Space at the Paris Exhibition of 1878 is to be devoted to Agriculture, and M. BARRAL informs me a series of pits will be regularly worked with various kinds of forage, as this system is admitted to be a great success in France.

There is no more frequent complaint in the present day than that of the difficulty of obtaining servants. The progress of education is rapidly making labouring people feel above their natural employments, and the rise of wages makes it incumbent upon scientific farmers to diminish the amount of labour by the largest possible use of machinery.

The self-acting manure fork, (sketched at page 37), adapted from the well-known American self-acting bucket, is a splendid

* I rely on the Indian and Colonial press to assist me in disseminating this information.

minimizer of labour, and most valuable as a means of rapidly removing manure from a tank.

Farmers are wanting in their usual prudence when they so carelessly store their manure in open places exposed to the action of the weather, and, to their utter loss, permit the most precious and fertilizing qualities to be drained away.

But if Englishmen are little enamoured of manure lifting still less are Hindoos, and the manure fork will therefore be found a very profitable addition to the plant of an Indian Estate.

The small Tan-testing Machine, described at page 49, has proved the value of Balsamocarpon, the pods of which were first seen in Europe at the Vienna Exhibition. This shrub grows in dry arid regions, and is well suited to parts of Australia, while its clear astringent gum will be found valuable for many purposes besides tanning leather.

The *Coffea liberica* described at page 54 is not the only plant useful to Commerce that Mr. BULL is growing. He has also plants of the celebrated "*Castilloa elastica*," from Central America, and of the India-rubber of Para, "*Hevea brasiliensis*." The sap or gum of both these trees commands a high price in the different markets of Europe.

I cannot sufficiently thank Dr. FORBES WATSON, Professor OLIVER, Dr. THISELTON DYER, and Mr. HENRY TRIMEN, M.B. for their kind assistance in aiding me to trace out some of these plants.

The Indian Government has also done a great deal to assist in the introduction of useful plants. If private individuals are willing to co-operate in the useful enterprise, the Government policy of non-interference with commerce will be strictly adhered to. Plant collectors and growers, whether at home or abroad, need not, therefore, fear any competition; while, on the other hand, every assistance will be readily extended.

T. CHRISTY, JUN.,

155, Fenchurch Street.



SKETCHED
FROM NATURE
AT THE

ROYAL
BOTANICAL
GARDENS, KEW
NOV. 1872.

SYMPHYTUM ASPERRIMUM.

IN the year 1790, the *Symphytum Asperum*, or Caucasian Comfrey, was introduced into England, and in distinction from the wild variety indigenous to England it was named Prickly Comfrey. It was known, in Russia and Circassia, to be an invaluable plant for medicinal purposes and forage, and when the vast flocks had fed off the herbage in the plains, the herdsmen retired to the mountains and valleys to seek forage for their cattle, for they found the Comfrey grew at as high an altitude as 4,000 feet above the sea level. The roots are sometimes used as food by the inhabitants. Its component parts make it an extremely rich vegetable, containing a large percentage of gum; the roots often attain 100 lb. in weight, and tap down into the ground eight or nine feet when the soil is open. By a curious provision of nature the crown of the roots frequently assumes the form of a hollow ball, and contains up to a quart of water; in the dry season this water turns into a black jelly or gum. From the year 1800, Prickly Comfrey was sold in single plants for shrubberies, as it was found to grow in the shade and reached the height of five or six feet. In 1830 it was introduced as a forage plant, and was found by many people to answer well. The *Farmers Journal* re-printed notices of the plant for the use of its subscribers, and at this time there was hardly a garden of any importance that did not possess a plant of Prickly Comfrey. Every chemist kept a supply

of the dry leaves, roots, and decoctions both for internal and external application; sweetmeats and jams were also made from the roots; it was considered a certain cure for all bronchial and chest affections. The root of the wild varieties growing in England was found to be a purgative, and also useful for medicinal purposes, and so closely resembled the root of the Caucasian variety that horticulturists sold it to the farmers as "*Comfrey-roots*," causing great disappointment to those who did not obtain the Caucasian or Russian variety—it got into bad repute in France for similar reasons. In the "correspondence," many interesting facts confirming the foregoing remarks will be found.

This plant both blooms and seeds, but the seed will not germinate in this country, except in a very small per-centage, and the plants raised by artificial means are not found to possess the properties of the true Caucasian variety. When the plant became known, a demand arose for the seed, which was collected and sold, but only a very small per-centage germinated.

Scientific men tried to account for this peculiarity, and many theories were propounded; amongst others:—That the bell of the flower contains a large quantity of honey, and the humble bee finding it impossible to reach the honey through the bell, eats out a hole at the base of the flower, into which the common bee and other insects enter. Another theory was—That the insects in this country do not travel up the stem of the plant to impregnate the flowers, owing to the prickly nature of the foliage. Others say that like the *Aucuba*, it does not produce male and female flowers on the same plant.

Artificial impregnation was resorted to, but with very little success, except when the pollen was taken from the wild borage plants. This produced varieties which did not contain the mucilaginous and other properties of the true Caucasian Comfrey, and the result is seen in different parts of the country, in a variety of Comfrey having a small foliage, and a pale indistinct colour of flower, sometimes pink, sometimes lilac or cream coloured. It is also devoid of that asperity peculiar to the true variety.

Having so far described the former history of trials of Comfrey as an agricultural plant, and shewn why it did not hold its ground, I propose now to prove its value as compared with other forage plants, by the opinions of scientific men, and the correspondence of growers.

PROF. JAMES BUCKMAN, F.L.S., F.G.S., &c., &c., late Professor of Geology and Botany in the Royal Agricultural College, sends me the following Paper on *Symphytum Asperinum* (Hortus Kewensis) THE PRICKLY COMFREY.

The genus to which this plant belongs is well represented by our native *Symphytum officinale*, of which we find the following description in Dr. SYMES New Edition of *Sowerby's English Botany*, which we here transcribe on account of its recent date.

GENUS SYMPHYTUM.—“Calyx five cleft or five partite; corolla regular, or nearly so, cylindrical-clavate; throat with five lanceolate acute scales; limb erect, sub-campanulate, five toothed; stamens exerted beyond the corolla tube, but included in the limb; anthers with short filaments, not apendiculate, not connivent round the style. Nucules ovoid, smooth, sunk in and attached to the flat receptacle by a concave surface. Soft or bristly hispid herbs, with succulent stems. Flowers in scorpioid racemes arranged in pairs, usually with opposite leaves at their base. Corolla large, yellow, blue, purple, red or white.

The name of this genus of plants is derived from the Greek word *συνφύσις*, to unite, because the species are supposed to agglutinate the lips of wounds.”*

From the same authority we learn that:—

“The Comfrey derives its name, according to Dr. PRIOR, from the Latin word *confirma*, from its supposed strengthening qualities. It is slightly stringent, and was formerly regarded as a stiptic and vulnerary. It was known to our fathers by the name of the ‘great consound.’ It was used for ‘griefes of the lungs,’ and possibly with good effect, as the leaves, stems, and roots, abound in mucilage. The young leaves, when boiled, form a tolerable vegetable, and are not unfrequently eaten by country people where the plant abounds.”†

Dr. SYME has described three native forms under the following names:—

A.—*Symphytum officinale*, var. *genuinum*.

B.— “ “ var. *patens*.

 “ “ *tuberosum*.

Both A and B are very common in ditches and damp places, and are often found growing together; they vary greatly in the colour of

* Vol. vii. p. 114.

† Ibid, p. 116.

their flowers, from quite white, through dusky purple, to a bright blue. They vary also in several points of structure, namely :—in hollowness and solidity of stem—as we have found them both in our own meadows—in a more or less hairy and decurrent, or scarcely decurrent leaf, and in more or less striking floral recemes.

We have not seen the *S. tuberosum*, but judging from our experiments upon the others and the *S. asperrimum* in cultivation, we are quite prepared to think it also a variety ; indeed we agree with BENTHAM, who speaking of the *Symphytum*, says :—

“The genus contains but few species, nearly resembling each other, and extends over Europe and Northern Asia.”*

It is highly probable then that the species may be prone to run into varieties, a matter of no little importance in an agricultural point of view, as one form may be more valuable than another ; and as the Prickly Comfrey has been recommended for cultivation, we shall devote a few remarks to some experiments connected therewith.

In the *Hortus Suburbanus Londinensis*, by Robert Sweet, F.L.S., published in 1818, we find the following list :—

1. *Symphytum officinale*..... Britain.
2. „ *tuberosum* „
3. „ *bohemicum*..... Bohemia.
4. „ *orientale* Eastern.
5. „ *tauricum* Tauria.
6. „ *asperrimum* Caucasus.
7. „ *cordatum* Transylvan.

Of these, one of the earliest introduced plants was the *Symphytum asperrimum*, described as finding a place in Kew Gardens in 1799. It was brought out in the year 1811 by the Messrs. Loddiges ; its graceful pendant, bright blue flowers, and bold foliage seeming to recommend it as an ornament to the shrubbery, or in the broader flower border where tall plants are desirable ; in such situations it has ever kept its place, and may frequently be met with about old places, especially at the sides of the private roads, taking its place with the mixed shrubs and showy flowering plants.

A little over thirty years ago, the English Agricultural press contained some notes upon the species as one deserving of cultivation for its cattle feeding properties, and we then procured some plants

* Handbook of the British Flora, p. 380.

for experiment and investigation, these we grew with the following results:—

Having procured a few sets with roots attached we planted them in a plot on the cold clay of the Forest Marble Rock, previously slightly manured. These sets grew rapidly, and we were soon enabled to divide them into more than a hundred individuals as before, which were planted in like manner, and so working on until we had as much as a quarter of an acre of ground occupied, and our crop was not only abundant, but some of the stems were a considerable height, some few having been left to show its mode of growth.

The rest however was used in various stages of growth as cattle food, though we must confess to having experienced no little disappointment on our first trials, yet no sooner did the cows, (especially milch cows,) horses, sheep and pigs begin to understand it than they eat it most greedily, and our report upon it was that while all creatures seemed to thrive upon the Comfrey, yet in no instance could we find the slightest evidence of any evil effects.

The crop was enormous, and this too upon land of very medium quality; but we have this year been trying its growth on light sandy soil, and can report that all through the season of drought the thick deep roots of the Comfrey have drawn up the moisture which rises hygrometrically in our sand bed, and the result has been a succession of green leaves when surface plants were an utter failure.

But to proceed with our earlier crops grown at Cirencester:—

A portion of this crop was analysed by Professor Voelcker in the laboratory of the Royal Agricultural College, the results of which are published in the journal of the "Bath and West of England Agricultural Society," from which we quote the following arrangement of its constituents, placed in groups:—

	Leaves.		Stem	
	In Natural State.	Calculated Dry.	In Natural State.	Calculated Dry.
Water.	88.400		94.74	
Flesh-forming substances. . . .	2.712	23.37	.69	13.06
Non-nitrogenised substances:—				
Heat and fat producing matters	6.898	59.49	3.81	72.49
Inorganic matters (ash)	1.990	17.14	.76	14.45
	100.000	100.00	100.00	100.0

To this analysis the learned Professor has appended the following remarks :—

“In its fresh state Comfrey contains still more water than white mustard ; but, notwithstanding this large proportion of water, the amount of flesh-forming substances is considerable. The juice of this plant contains much gum and mucilage, and but little sugar.”

From our own practical experience we conclude that we have in the Comfrey a plant capable of conferring great benefits on the farmer, at the same time it must be confessed that, like wheat or potatoes, there are sorts of this plant, and one sort is better than another.

Lately, the Messrs. CHRISTY & Co. have introduced a form of Prickly Comfrey, which is distinguished from the ordinary one by a solid stem, and they claim for it an advantage over the common form, inasmuch as it contains a greater amount of mucilage and yields a larger produce.

We have since observed the same in our wild forms ; sometimes the stems are solid, both in the typical *S. officinale* and its variety, *S. patens*, which confirms us in our former conclusions as the result of experiment that they are only varieties, though from all the evidence we can collect upon the subject, we are bound to conclude that in this, as in other cultivated plants, a variety is often of greater consequence than an admitted species.

The importance of the kind of Comfrey, now recommended, by Messrs. CHRISTY & Co., has been shown to us as the result of experiment.

In the present year we had sent us by Mr. T. CHRISTY, a specimen of the new plant, it consisted of a single root with flowering stem and flowers just opening, these were employed as follows :—

Experiment 1.—The root cutting or set was planted in our garden, and upon being lifted in this month of November, 1876, it was so like the engraving on page 1, that it might have been taken from our specimen.

Experiment 2.—The stem was made into four cuttings and put into a pot, of these, three rooted and grew very well, showing how easy it is of propagation.

Experiment 3.—The main plant has just been divided into six sets, and with the three cuttings they occupy a place in our experimental garden.

It should be observed that some days since we had a few of the green leaves, from the main plant, boiled, with a view of testing the qualifications of the Comfrey for a pot herb, and we must confess that we found it very agreeable, as much so as our most delicate greens and spinach.

The drawings made at Kew give a good notion of the plant. The whole plant is useful for feeding purposes; in fact it grows so rapidly that it is usually all fresh at once.

In our own use of it we began cutting it down as soon as the flower buds showed themselves, taking care not to injure the base more than necessary. The best way to gather it, is to hand-pick, guarded with a glove, as a bruised wound does not bleed so much as a sharply cut one.

When gathered, a little rotten dung may be put between the rows, and the ground afterwards stirred up with a light tined cultivator, or the latter implement may be used first, and then long dung spread thinly over the surface afterwards, thus furnishing nutrition gradually, and yet protecting the soil from too rapid evaporation in seasons of drought.

The coloured drawings to the right of second sheet are about the size of nature, and from them we see the difference in the stems.

Now it should be stated that in all probability our earlier experiments were conducted with the hollow-stemmed sort, but we are now growing the solid-stemmed kind, which we have no doubt will prove superior, not only as yielding a heavier crop, but from the mucilaginous nature, especially of the stem.

These are facts which have been largely tried and investigated by many able experimentalists.

Prof. J. A. BARRAL, Perpetual Secretary of the Central Society of Agriculture in France (*Société Centrale de l'Agriculture en France*) writes in the *Journal de l'Agriculture*, of 7th October, 1876 (No. 391).

For some time past the attention of Agriculturists, particularly in England, has been given to the Caucasian Prickly Comfrey (*Symphytum asperrimum*) of the family of Borages. It is particularly pointed out as a forage plant of great abundance.

It is not, however, a new plant, for its importation into England may be traced back as far as 1811, and it has already been tried in France. M. VILMORIN speaks of it in his *Bon Jardinier*. He says, "The first trials of the plant have not succeeded on a dry poor soil, but in deep earth it has fully proved its claim as an abundant, and early spring yielding plant. In the month of April it gives a good first cutting. Cows do not eat it eagerly at first, but they soon become accustomed to it. We believe that Comfrey will certainly take its place amongst those early spring forage plants, which especially for farm cultivation, may be very usefully employed. It is hardy and very long lived."

We see therefore to-day the revival of a plant which at its first introduction into cultivation, was restricted to small farms and not used as a forage plant in a large way. The cause of this is perhaps owing to the mode of cultivation, and the manner of propagation which had been adopted, or perhaps to the large number of species of Comfrey commonly known, and with which the Caucasian variety may easily have been confounded.

The promoters of the new campaign in favour of the growth of Comfrey, take care to point out that in our climate we must entirely give up the idea of propagating the plant by seed, but that sets, shoots, or crowns, which sprout from the top or stump of the root, and which spring up immediately they burst through the earth, are suitable for the purposes of propagation.

All the different Comfrees are favourably known, and peasants in the country know particularly well the large Comfrey (*Symphytum officinale*) which they have christened amongst themselves, "cows tongue (*langue de vache*)" and "cutting grass (*herbe à la Coupure*)" besides other names. The name of Comfrey is derived from the property it possesses of curing wounds. In their *Manuel des Plantes*,

MESSRS. JACQUES & HERINOQ, describe ten different varieties of Comfrey and endow them with the following properties :—" Comfrey requires depth, but grows in all kinds of soil. It is propagated by dividing the crowns. The flowers are very pretty, though the stalks from which they grow are not at all graceful. Comfrey root is used for different sirups, generally in a dry state ; but in cases of rupture and for strains, it is better used green. When dried and powdered it makes a beautiful red colour. In some parts of the country the young leaves are used for making soup. Tanners and Dyers both use it ; a glue is made from it and used in the preparation of the wool, when mixed with goats hair, without which it could not be spun."

From these particulars it becomes evident that Comfrey is an interesting plant to cultivate ; but what appears to us to recommend Comfrey is the large quantity of forage it yields. Two sets put late into the ground, in the month of May, in a fairly deep soil, but of poor quality, gave on the 29th September, the one—a cutting of 3.250 kilogs, and the second—a cutting of 1.850 kilogs. The height of each plant was 40 centimetres, diameter 85 centimetres. The appearance was that of the woodcut, drawn from nature at the Botanical Gardens, Kew, in England. Two cows to which we offered the leaves, freshly cut, eat them at once, in spite of their roughness. The quantity of water is 88 per cent., and the proportion of Azote (Nitrogen) 0.4 per cent. in the green state, or about the richness of green maize. The total of azote substances is about one-third, a remarkable richness, and which justifies the high opinion that cultivators, who have tried it, have formed of the plant. The sets on which we experimented were given us by Mons. A. E. RAGON. The house propagating the plant is that of MESSRS. THOMAS CHRISTY, & Co., of 155, Fenchurch Street, London.

We will not further insist upon the healing properties which it is said Comfrey possesses, but as the quantity of green forage obtained per hectare, in a soil deep and moist enough for vegetation, appears to rise as high as 300,000 kilogs per hectare, and perhaps more, it is certainly a plant to be tried, particularly for "pickling purposes" in tanks or pits, (particulièrement au point de vue de l'ensilage) in order to provide green food for cattle throughout the winter.

J. A. BARRAL.



SOLID STEM COMFREY.

CHRISTY'S NEW VARIETY.

*Produced from a crown-cutting, planted in February, 1876. Sketched from nature July 31st of same year. Height of plant 4 ft.; Circumference 7 ft.
Grown by Mr. H. DOUBLEDAY, Coggeshall, Kelvedon, Essex.*

THE SOLID-STEM SYMPHYTUM ASPERRIMUM OR CAUCASIAN PRICKLY COMFREY.

THIS variety of Prickly Comfrey has a solid stem, full of gum and mucilage. The old varieties and other species, both cultivated and wild, have hollow stems. The leaves of this variety have also the same rich, gummy and mucilaginous character, and attain to a great size, often three feet long, the plant rising to a height of four or five feet when it first shows for flower. It will be readily understood that the solid substantial character of this variety produces a greatly increased weight of food per acre.

It is a very ornamental plant, and bears a profusion of blossom very rich in honey. This imparts a sweetness to the plant which animals are very fond of, and when dried the stem and leaves have a most agreeable perfume. The dried leaves give a solution in water, very much resembling low-class Chinese Tea, and have also the same rough flavor, both plants containing Tannic acid. This Solid Stem Prickly Comfrey branches out much more than the old varieties, so that though the plants be placed three feet from each other they soon cover the ground. The crown sets and stem cuttings blossom the first year, but as a rule the root cuttings generally not till the second year, but the latter produce an amazing quantity of leaves forming a head of great beauty from the graceful wavy curve of its long leaves, (*see plate*). No other cultivated plant produces the enormous weight per acre of such valuable food.

Instead of the starch found in cereals, plants and roots, Prickly Comfrey contains gum which is nearly of the same chemical composition as sugar, and is intermediate between the two, (as starch in the germination of grain,) or when acted upon chemically is first changed into gum and finally into sugar. The same changes occur in the mouths and stomachs of animals eating such food. There is no doubt as this plant becomes generally known, its cultivation will be largely increased. It is by no means an expensive crop to grow, for though the first cost of planting may be rather more than that of Cabbages, the duration of the crop for fifteen or twenty years without





SOLID STEM COMFREY.

CHRISTY'S NEW VARIETY.

Produced from root-cutting, planted February, 1876. Sketched from nature July 31st same year. Height of plant 3 ft.; Circumference 9 ft. Grown by Mr. H. DOUBLEDAY, Coggeshall, Kelvedon, Essex.

renewal and the small expense attending its cultivation, make it one of the least costly crops grown.

There is another great advantage which this Solid Stem variety has over the Hollow Stem in propagating. The stem has the nature of a succulent root, and if pieces of the stem are cut with two eyes,

and planted in the ground and kept moist, they strike very quickly and flower during the summer, throwing down large solid roots, producing six or eight crowns the same year. Though the plant cannot be produced from seed, this valuable property and its certain growth from root and stem cuttings, make it of easy culture, indeed it is not exceeded in its multiplying properties by the cereal crops ; a plant of a year's growth will produce in root and stems fifty-fold, if taken up and replanted by dividing its crowns and roots, besides the cuttings taken from each flower stem during the year.

The healing powers of the plant are very considerable and are well known to people in those parts of the country where Comfrey has been at all cultivated for any length of time. I have myself frequently proved its efficacy in healing up the flesh of a wound or cut, by rubbing in the sap from the leaf or stalk, and have found the place heal very quickly under this treatment. There is no doubt that these healing properties extend to animals suffering from foot or mouth disease, foot rot, &c., and if fed regularly upon this food, we have good reason for hoping its use would entirely prevent such diseases.

An impression prevails in some quarters that animals will not eat it—this is quite a mistake ; it may have arisen from persons confounding some of the wild species with the cultivated ones, and I might as well compare a crab with an apple, or a cabbage or mangelwurzel with the little wild annual plants from whence they are derived, and found growing upon our sea coast, as the valuable cultivated species of Prickly Comfrey with these wild and worthless plants. There is positive proof from all quarters that the cattle, &c., do eat it greedily. It sometimes happens that the first time an animal is offered Comfrey it does not take the new food as readily as that it has always been fed upon, but if persevered with for a few days Comfrey never fails to become the favourite feed of any animal, and on none do they show so quickly such an improvement in condition. The advantages of *Symphytum Aspernum* are, briefly:—Its very quick growth and easy cultivation, and its heavy yield of fodder ; the reliance that may be safely put on the crop, as it is nearly independent of weather and will still yield fresh green leaves through the longest and driest summers. It withstands both heat and cold, growing in the hottest climates and in as high latitudes as

St. Petersburg and the Caucasus. Its introduction into general cultivation ought to be encouraged by everyone who knows from experience the difficulty of providing stock with green fodder in early spring or through a summer when the droughts have reduced the number of green-feed giving plants to one, viz., *Symphytum Asperrium*.

HENRY DOUBLEDAY.

DEAR FRIEND,—I have taken a great interest in the cultivation of Prickly Comfrey, from a belief that it will prove a valuable plant for general cultivation. When I first divided my roots, about four years ago, I planted also the root cuttings experimentally. I found these grew satisfactorily in a very peculiar way—a circle of leaves were produced around the top of the inner bark of the root, while the root-fibres formed all over the outer bark. The next season I cut the roots into smaller pieces, and these also all grew in a similar way. My opinion is that there are a few fertile seeds, but certainly not one per cent. ; but as the root cuttings are so successful we have ample means of increase. My experience in feeding was quite satisfactory. Lambs and Pigs were extremely fond of it green, and did well. They are also very fond of it in the dry state.

My land is a heavy clay, on which the Comfrey grows luxuriantly, the roots striking down deep into the ground. Last year my first cut was from three to four feet high, (plants three feet apart) some producing ten lbs. each plant, or 21½ tons per acre, at the first cut 15th May.

Yours truly,

THOMAS CHRISTY, Jun.

H. DOUBLEDAY.

COGGESHALL, ESSEX, 10th July, 1876.

DEAR FRIEND,—I think the *Symphytum Asperrium* will prove a highly valuable plant for India—quite a mine of wealth for the farmers who keep cattle. Its extreme luxuriance and its power of withstanding a long drought mark it out for such a climate. I had a proof of the fondness of Goats for the plant, having been obliged to part with a favorite one because I could not keep it away from my Prickly Comfrey, though it had plenty of other good food. I have examined the *new variety of Symphytum Asperrium* you are about to introduce, which has a solid stem, full of gum mucilage, which will prove of great value (in my opinion), as the produce will be greatly increased in richness and weight, the present variety having a hollow stem. Four or five cuts, of 20 tons each to the acre, may be taken when the plants are fully established, and they will last for 20 years if the ground is kept clean and occasionally stirred. I feel certain it will be a great boon to India for general cultivation.

Yours truly,

THOMAS CHRISTY, Jun.

H. DOUBLEDAY.

To the Editor of the Essex Herald.

SIR,—I have just read with interest in your paper of the 2nd inst. a letter from Mr. H. Doubleday about Comfrey.

Now that Prickly Comfrey (*Symphytum asperitimum*) is admitted by all farmers and stockowners who have tried it to be the most valuable of all forage plants grown in this country, and while the cultivation of it is becoming so general, it would be well for all who propose growing it to remember the importance of planting only the true Caucasian Comfrey, and not wasting time, trouble, and money on any of the worthless varieties.

I had a good opportunity of comparing the right sort with the wrong last August in Kent, when I found the two growing within a mile of each other, on precisely similar soil and under equally favorable circumstances. One had been planted in the spring, had been cut twice, and looked ready for cutting again. The owner, a cowkeeper, was loud in its praise, and only regretted not having treble the quantity.

The other belonged to a farmer who had been persevering with it for nearly three years, and trying in vain to discover the value of Comfrey as food for his stock. The owner told me that he had never got more than one light cutting a year from it, and that its effect on cattle was anything but beneficial, having always produced excessive purging, and that he intended having it all dug out of his ground as worthless.

The appearance of the two crops as well as the owners' reports being so entirely different, led me to inquire where the roots had been originally obtained from. In reply, the farmer told me that he had obtained his from the Channel Islands, Wales, and elsewhere; and the cowkeeper that he had got his from T. CHRISTY & Co., of 155, Fenchurch Street, London.

I have just planted about 2,500 sets obtained from CHRISTY & Co., and shall be well pleased if the result proves as good as what I have seen growing from sets supplied by this firm. I have also planted some of the solid stem variety, which, from Mr. Doubleday's account in his letter to you of the 30th ult., seems to be even a still more valuable variety.

The importance to farmers of planting only the right sort I feel sure cannot be too strongly urged.—I am, Sir, your obedient Servant,

ROBERT G. D. TOSSWILL.

The Lodge, Chingford, Essex. Nov. 9th, 1876.

LAGARDE-MONTLIEU, 11th September, 1876.

The Agricultural Society of the arrondissement of Jonzac have awarded me the First and most important Prize and given me a Medal for the introduction of a new Forage plant. The Committee visited my plantation of *Symphytum asperitimum*, studied the cultivation, and saw how all my cattle liked it. I need not tell you what pleasure this result has given me.

E. CROSNIER.

DUBLIN, February 29th, 1876.

DEAR SIR,—As I promised, I write you an account of my experience of the value of Prickly Comfrey. In the month November, 1839, I obtained 300 roots of Comfrey, and planted it in drills 3 feet apart; I had a valuable hunter, who after a severe cold, broke out with button farcy, and nearly died; he was cured at a veterinary hospital, and sent home a miserable object—his coat all covered with dried scabs, and scarcely able to walk. My steward being afraid to put him out to grass, had him put into a detached stable, where he was loose, and allowed nothing but Prickly Comfrey, which at that time (1st week in May) was in blossom. At first the horse would hardly eat it, but in a couple of weeks, he would come neighing to his stable-door at feeding time; at last the boy attending him, told my steward that the horse was (to use a phrase) jumping out of his skin. I came down to the country at this time, and went to see the horse; his old coat was now falling off him in great flakes, and under it he had a beautiful new coat like velvet; at the end of two months, on this food, he was perfectly recovered, and in splendid condition. I find this is first-rate food for carriage horses—that is, to give two good feeds of it daily, along with a very small quantity of hay, and their usual measure of oats, as it never purges, and gives them a very fine coat. I also found the cows that were fed on it gave much more milk than the others, although they were all on good pasture.

(Signed) W. BRABAZON.

To THOMAS CHRISTY, Esq.

HIGHWOODS, BURGHFIELD HILL, October 11th, 1875.

SIR,—I purchased the plant S. A. years ago; it certainly is a wonderful grower. Pigs, Sheep, Cows, and Horses I fed with it most satisfactorily.

I had great difficulty in proving to the farmers but what it was the S. indigenous to Great Britain, so I planted some of the latter and they were convinced. I am glad you are bringing it before the Agricultural world; I wish you success.

Yours obediently,

W. J. BRYANT.

October 14th, 1875.

DEAR SIR,—You are at liberty to quote from my letter regarding the Prickly Comfrey. Mixed with chaff it will bring horses rapidly into condition. Cows are shy at first, but soon take great liking to the plant. Fowls, Pigs, and Rabbits eat the *true* *Symphytum Asperinum* greedily.

THOMAS CHRISTY.

Yours faithfully,

W. J. BRYANT.

CHALK HILL FARM, KINGSBURY, N.W., September, 1876.

DEAR SIR,—It affords me pleasure to testify to the real excellence of the "Caucasian Prickly Comfrey," as green food for Cattle; it increases the milk of Cows, fattens Stock, and materially improves the condition of Horses. This year I have had six cuttings from the Plant!! It is a most important adjunct on a farm, and in my opinion requires to be more extensively known.

T. CHRISTY, Esq.,

Yours faithfully, H. D. RAWLINGS.

EXTRACTS FROM "THE FIELD."

A writer in the *Field* of December 17th, 1870, states—It is nearly forty years since my attention was directed to Prickly Comfrey,—its excellences as a food for cattle, its specialities, the chief of which is its rapid and continuous reproduction.

I procured in the year I spoke of (about 1832) twenty-five sets of the Prickly Comfrey, taken immediately from the plant grown on the spot. I know of nothing at all comparable to it to set before cattle for nourishment. If they do not take to it at first, they soon come round to it. Where cows are kept, there is nothing probably that can be so advantageously placed before them when they are tied up for milking.

The weight of each leaf will be somewhat more than an ounce. When the whole crown was taken at once, it was reproduced in the short space of ten or twelve days in the summer time, and in a fortnight or a little more in late spring and autumn. The leaves begin to show themselves in April, and have lasted to the end of October.

As to the place where Comfrey is to be planted, any soil seems to suit it. I have, where I am at present, two spots where it is planted: one, an open sunny place on almost a sand; the other, a stiff clay against a north wall; and they seem to do nearly equally well in both. I tried levigating the clay with ashes—both wood and coal ashes: no decided result. From manure no decided result. My notion is that the plant derives a good deal of nourishment from its decayed leaves in autumn, which I have always left.

The plant, I have before said, I propagated in the first instance from cuttings or divisions of the root. A root will divide into six or seven cuttings, and may be planted at any time of the year.

I have been in the habit of giving horses that were kept in the stables in the summer a daily allowance of 8lb. with very good effect. They become very fond of it. It keeps them cool, and is a *diuretic*.

I should add that *Symphytum Aspernum* is a perennial, and that it does not appear to have declined at all in fourteen years—the longest experience I have had of it at one place.

R. B. B.

30th October, 1875.

In the correspondence respecting this most valuable plant, one important use has been overlooked, namely, as a plant affording the best cover for game, especially in dry summers, when there is a scarcity of root crops. Game of all kinds harbour in it, and rabbits cannot eat it down owing to its rapid growth. The plant is a very sightly object on the farm or preserve.—J. H. L.

October 23rd, 1875.

FOOT-AND-MOUTH-DISEASE.—I have eight dairy cows; one was affected with foot-and-mouth disease on the 8th September last. Two of the eight have escaped altogether, and under circumstances which lead me to believe that the distemper is not infectious. While five of the six cows were at the worst finding they could not bite grass, I pulled mangold leaves, which, as the cows opened their mouths to lick them, I contrived to push far back on the tongue, when they would eat them, and, after tasting one or two, would pick up and eat any I threw to them. Some of these leaves, after rolling about in their mouths, they would drop, and these were picked up and eaten by the two non-affected cows. Believing then the disease to be infectious, I concluded that after eating leaves covered with saliva of affected animals, these two would not escape; but as they have, I attribute the mildness of the attack in my animals to their having been drenched as soon as the complaint appeared, and also to the use of Prickly Comfrey, with which they have been fed at midday for some months. As Comfrey is said to be valuable as a febrifuge, and as it also affords much mucilaginous food, I have no doubt that its influence is great in lessening the violence of this complaint, and keeping up a healthy condition in all animals fed upon it. I planted rather less than half an acre of Comfrey in March last, have cut four crops from it, and, I am surprised by the very heavy yield of food it has given, and am about to enlarge the planting to one acre, and expect when it has fully developed, that it will keep my eight cows for six months in each year.—W. L. C.

Ed.—Our correspondent bases his conclusions on very plausible premises.

BURRAGE HALL, HINCKLEY.

I am glad to see again, in the last issue of your paper that two correspondents draw attention to the value of *Symphytum Aspernum*, or Prickly Comfrey, as a preventive and curative against the ravages of the foot-and-mouth disease. Long before Comfrey was utilised as a forage plant, its medical and curative properties in allaying fever, &c., were very well known, mention of this fact being found in most of the leading botanical and medical works which describe the plant. In confirmation of the remarks of W. L. C., I may state that I lately turned a cow, which I have occasionally fed with Comfrey during the past two summers, amongst a herd of eighteen or twenty other cows, all of which were bad with the foot-and-mouth disease, and although she has now been feeding in company with these cows for six weeks, she continues perfectly healthy. There is I think, no plant that grows so luxuriantly, or that can be more rapidly multiplied. A very large quantity of *spurious* and *utterly worthless* varieties have been sold in this country under the name of Comfrey; hence the importance of securing the correct thing.—KINARD B. EDWARDS.

THE PRICKLY COMFREY IN VIRGINIA.

SIR,—Having been induced by the perusal of an article in your valuable paper, to attempt the cultivation of Prickly Comfrey in Virginia, I send you a few lines to inform you of the result.

In March last, I obtained from Messrs. CHRISTY & Co., London, some sets of the true *Symphytum Asperrium*. There was some delay in New York before I received them, and I was prevented putting them into the ground for about ten days, owing to severe frost. Notwithstanding these drawbacks, the sets thrived remarkably well, and, during the first fortnight in April, I was able to remove a quantity of healthy, vigorous plants. I have, during the past six months, taken four or five cuttings of leaves, and my plants continue to increase in size. I have also sub-divided many of the roots with entire success.

We have had a long drought of nearly three months, followed by almost incessant rain for a fortnight, and in consequence the crops have suffered severely; but, at a time when everything else was burned up, the Prickly Comfrey continued to afford abundant green fodder for my horses and stock.

My experience agrees with that of others, that the leaves are readily eaten by all domesticated animals, and that they are of the greatest use in getting horses into condition.

I may mention that my land is not particularly good, and that the Prickly Comfrey has had no attention beyond being manured when the sets were first put out, and being kept clear from weeds.

I consider it a most valuable plant, and decidedly the most satisfactory thing I have seen since leaving England. The terrible want of some good fodder plant is severely felt here, and people are beginning to see that the *Symphytum Asperrium* will supply their necessities. The newspapers are taking the matter up, and already there is much interest shown on the subject.

Richmond, Virginia, Sept. 28.

C. E. ASHBURNER.

DRAYTON LODGE, THIRSK, YORKSHIRE, 13th May, 1876.

GENTLEMEN.—Please to forward me your prices current for *Symphytum Asperrium*, and any pamphlet you may have published on the subject. I suppose it is not too late to set a couple of hundred plants in a ploughed field for future sets. I have been thinking of breaking up a badly laid 2½ acre field and planting it with Comfrey.

Messrs. THOMAS CHRISTY & Co.

I am, yours, A. T. ATWOOD,

Will the inclosed paper be of service.

"*SYMPHYTUM ASPERRIMUM*.—Named from *συνήσις*, a union or junction; the Plant having for a long time passed for a famous vulnerary, highly mucilaginous. *Symphytum Asperrium* flowers the whole season."—*London's Encyclopedia of Plants*.

"GERADE, recommends it highly as a salve for external wounds, for internal hemorrhage, and for disorders of the kidneys."—*Herbal*, p.p. 806, 807.

"GERADE gives, as his wont is, a recipe for a syrup—main compound being Comfrey,—use internal. Its mucilaginous character points to the source of its value in cases of Lung, Foot, or Mouth Diseases."—A. T. A.

CULLOOR ESTATE, VYTHERRY,

October 2nd, 1876.

THOS. CHRISTY, JUN., Esq., LONDON.

DEAR SIR,—Thus far I am glad to be able to report most favourably on the progress of the Comfrey roots I brought out with me here for the Tambracherry Coffee Estates Company. I have had them planted on a low marshy soil, in ridges three feet apart, taking care, previously, to have the soil broken up two or three feet deep, and at subsoil of the ridges making a good coating of cattle manure mixed with jungle soil. By this cultivation the roots will not only have considerable depth of soil to grow in, but in the event of having a dry season, the manure being placed at a fair depth under the top soil, will tend to make it moist for a very considerable time. I was greatly surprised at the quick germinating qualities of these roots, which in several instances had not been planted more than forty-eight hours, at about three to four inches below the surface, and eight had appeared in that time one inch above the surface. I also found after a voyage of six weeks from England, on opening the case, that the roots had germinated a little. The Comfrey has now been planted about ten days and promises well. I only hope our cattle will take to it here, as, being so quick in growth, it will be *invaluable* in my opinion, here on Coffee estates, as a standard food for cattle. Grass is often difficult to obtain during some seasons of the year. I shall advocate its trial to my agricultural friends in Norfolk, and I am surprised it is not more generally grown. To a dairy farmer it would be an acquisition. I confidently expect to get here, a *crop every two months*, if not more frequently. I will write to you again when it comes to maturity and give you my opinion of it as a cattle food.

I am, Dear Sir, yours faithfully,

(Signed) CHAS. DRAKE,

Cattle Inspector, on Tambracherry Coffee Estates,
in Wynaard, Malabar Coast, India.

Mons. PERIN, Member of the St. Marcellin Agricultural Society, writes on the 1st ult. to the *Journal d'Agriculture Progressive*:—"On the 1st of May, 1875, I received fifty-two plants from England, and set them on the 3rd. In eight days the leaves appeared, and I remarked very vigorous vegetation. This plant requires a rather deep and humid soil. It serves as food for kine, and its growth is so rapid as to admit four cuttings a year, the first at the end of April, and every two months afterwards. The time for cutting is indicated by the formation of the flower-stalks. The Comfrey stands the cold of Isère—even the late frosts of April—and produces three kilogrammes per head. It is planted at a mètre apart every way, which gives 10,000 per hectare (2·471143 acres), and consequently 30,000 kilogrammes (66,165 lb.) of green fodder for cutting, and 120,000 kilos (or 264,860 lb.) a-year! Dr. Vœlcker's (of the English Royal Agricultural Society) analysis has determined the goodness of this plant as a food for cattle and milch kine. The propagation of the Comfrey is very easy, and is made by cuttings. Each year's root can yield

twenty new plants, which may be set either in the spring or the autumn. At the close of September, 1875, we made an experiment, in order to ourselves verify the qualities of this forage plant. We were able to make two cuttings in June and August, and to determine that from a productive point of view the plant was good. With the August cutting we fed four horned cattle for a week. They ate the forage well, and the milk of the cows increased. We shall soon make the last cutting for October, and shall then be able to continue our trials, with which we will keep you acquainted."

LAGARDE-MONTLIEU (Charente Inférieure)

29 *Juillet*, 1876.

MON CHER MONSIEUR,

Ma plantation de *Symphytum Aspernum* Le sac de 500 racines que vous m'avez envoyé m'est arrivé le 10 Mars.

Les plants ont été immédiatement mis en nourrice, pour activer la pousse des racines, suivant vos instructions.

Peu de jours après j'en plantai 60 dans un carré de terre sablonneuse et quelque peu argileuse (silico argileux), le reste fut planté dans deux carrés de terres dites terres fortes (Argilo calcaire).

Cette deuxième plantation eut lieu pour la majeure partie dans la première quinzaine d'Avril le reste dans la deuxième quinzaine.

Les premières pousses eurent lieu vers le 1^{er} Avril. Le 15 Mai tout était sorti de terre sauf, un très-petit nombre d'exceptions qui sont sorties plus tard.

Dès les premiers jours de Juin, les 60 plants du carré silico argileux où l'eau avait trouvé un écoulement facile commençaient à fleurir et avant la fin du mois de juin j'étais obligé de couper toutes les tiges à fleur afin de ne pas les laisser grainer.

Quant aux plants placés dans les 2 carrés argilo-calcaires, ils sont venus plus lentement mais avec un développement beaucoup plus considérable et ils paraissent aujourd'hui souffrir à peine de la sécheresse excessive qui règne en France depuis quelques semaines.

Il y a un mois j'ai voulu me rendre compte de la pousse intérieure dans la terre j'ai déraciné un pied quelconque et après avoir coupé les feuilles au ras de terre, j'ai trouvé que le petit morceau de racine informe que j'avais planté ayant à peine 3 ou 4 centimètres de longueur était devenu à la partie supérieure une couronne ayant 6 à 7 centimètres de diamètre au-dessous de laquelle sortait une douzaine de racines de la grosseur du petit doigt et longues de 20 à 25 centimètres.

J'ai coupé cette racine en deux parties égales, j'ai disposé d'une moitié en faveur d'un ami et coupé l'autre en plusieurs morceaux que j'ai plantés immédiatement.

Huit jours après les morceaux de la couronne (il y en avait deux) sortaient de terre sous la forme de jeunes feuilles. Les racines ont été plus longues à venir

elles ne sont pas encore toutes sorties, mais il faut tenir compte de la sécheresse de la saison (2 mois sans pluie).

Pour terminer mes observations sur ma plantation; il y a dix jours j'ai fait une coupe en règle de la moitié de chacun de mes carrés aujourd'hui même j'ai constaté, le mètre en main que le plus grand nombre des plants a poussé à 30 ou 35 centimètres de hauteur et les moins favorisés ont 12 à 15 centimètres.

Si l'on tient compte du temps depuis lequel mes plantations sont faites, on se demande quelles seront leur vigueur et leur prodigieuse fertilité l'année prochaine et plus tard.

J'oubliais de vous dire que j'ai été fort anxieux de faire l'expérience du plus ou moins de goût de mes animaux pour le S. A., cette expérience a parfaitement réussi.

Je leur ai donné sans préparation aucune et en supplément de leur nourriture habituelle des feuilles et des tiges, tantôt fraîches, tantôt à moitié sèches.

Cinq vaches sur six ont mangé sans aucune hésitation la sixième a senti avec un certain dédain; mais en revenant un quart d'heure après le *Symphytum* a toujours disparu.

Quant à ma jument, je l'ai vue laisser son ratelier garni de foin pour venir manger les feuilles que je lui donnais dans son box.

Les autres animaux, les porcs, les lapins en sont très-friands j'ai même lieu de supposer que les lapins sauvages me donneront du souci pour la protection de ma plante, car je trouve souvent des feuilles mangées du soir au matin. Enfin dernier fait caractéristique, un domestique ayant laissé contrairement à mes instructions un troupeau de 20 dindons pénétrer dans une pièce voisine d'un carré de *Symphytum*, ils ont négligé le pré où on les menait paître pour dévaster le *Symphytum* heureusement que le dégât a été promptement réparé, grâce à la rapidité de la pousse.

Voici mon cher M. CHRISTY un compte rendu fidèle des résultats obtenus par moi je vous le donne avec la plus entière sincérité, j'ajouterai même que sur certains points je suis resté au -- dessous de la vérité dans mes appréciations.

Votre dévoué,

Mons. THOMAS CHRISTY,
155, Fenchurch Street, London.

E. CRÔSNIER.

EXTRACT FROM "THE TIMES OF INDIA,"

April 16th, 1876.

How many have observed the loathsome repast of the Gáumtee buffalo, whose tainted milk carries down with it the germs of typhoid fever? What Commissariat officer is there that would not see State camels, horses, and *biles* fed for half their present cost, and secure good beef and mutton. Plant the *Symphytum Aspernum*, or Caucasian Prickly Comfrey, throughout the length and breadth of India; it may have much to do with the progress of India, probably not less than Cotton has in times past. Being *deep-rooted*,

it is independent of the weather and climate, it is only cut down by severe frost; being perennial, once planted all expense is at an end, and the crowns or plants increase in size each year. Any soil but chalk suits it; it is most easily propagated by a bit of the root. Nothing in the shape of forage is comparable to it to set before horses and brood mares, cattle and live stock of all kinds. It is a valuable febrifuge and a diuretic. It ought to be tried in every Collectorate, in every Government farm and garden from Cape Comorin to the Khybur, from Sylhet to Kurrachee. The roots can be shipped in boxes as ordinary merchandise in the hold. The plant cannot be propagated from seed, as not one per cent. will vegetate.

Mr. STORMONT, the Superintendent of the Government Model Farm, Khandesh, writes on 5th August:—"With regard to the Prickly Comfrey, I hear that it grows luxuriantly on the Alligaum Stud Farm."

Extract from Leading Article

In the "CEYLON TIMES OVERLAND SUMMARY."

December 7th, 1876.

"Mr. Wilson's letter in our present issue bears testimony to all that has been written of the rapidity of growth of the Prickly Comfrey, showing clearly enough that it is a plant specially adapted to the soil and climate of this country. There should be no reason why it might not be grown successfully on most of the poor waste lands of the low country.

"With this plant at their disposal the natives of the poorer districts of the maritime provinces, might turn to good account many an unproductive field, many a barren waste. We commend the idea of the Government, which has resolved on establishing an experimental garden at Meeriagama, for the special development of products suitable to native industry. A better plant could not be grown for general distribution than the Prickly Comfrey, which might be gradually distributed amongst all villagers applying for cuttings of it.

HOME CULTIVATION
AND TREATMENT OF
SYMPHYTUM ASPERRIMUM,
OR
PRICKLY COMFREY "SETS."

On the receipt of the Crown sets place them at once in the field, if there is no frost. Root sets, place on the ground, if in winter, in some warm sheltered situation, and arrange so that every 100 sets shall cover an area of two feet long by two feet broad; after so doing, cover the roots to a depth of 2 inches, with rich garden loam soil, well manured; in a short time the sets will appear above ground, having thrown out a mass of white fibrous roots; in ten days or so the "sets" may be taken up and planted in the open ground. They may be put in a frame if time is an object.

In spring and summer if planted in the field at once they will thrive, but in dry hot weather water them a few times. In planting on a moor or boggy land it is only necessary to make a hole with a bar, and drop in a large set. The root-sets should be planted *perpendicularly*, with the *thin end downwards*. It does well on a loam and a stiff CLAY soil, and taps down deep into a sandy soil.

The best site to select for planting is that nearest to where the cattle will be fed, to save carrying such a weight of forage further than necessary, and to ensure its being cut regularly.

The plant should be cut as soon as it shows for flower—when allowed to flower it weakens the root and it runs into stem.

If planted in woods for harbouring game the sets may be placed closer together, and the flower stems will rise to five or six feet high.

Price in bags, delivered in London, £4 per 1,000 sets; special terms for quantities.

Solid-Stem variety, single crowns, sent post free to all parts of the U.K. for 1s; large reduction for quantities of more than 100 crowns.

FOREIGN CULTIVATION.

With Orders for Exportation we supply roots, packed in felt-lined cases* at five guineas each ; half-cases, three pounds, delivered free of freight and insurance at principal Ports of INDIA, CEYLON, AUSTRALIA (by Peninsular and Oriental Mail Route), NEW ZEALAND, SOUTH AFRICA, and UNITED STATES, in direct communication with England.

Five cases of Roots will plant an acre or more, and can be delivered as above for *Twenty Pounds*. The following is the way the cases should be treated on their arrival out:—

The roots should be taken from the cases, planted and kept shaded and damp until the leaves appear, and the fibres get hold of the ground. They may then be sub-divided, and the smallest pieces will germinate. There should be three feet left between each set in planting.

As a rule, however, the roots arrive so fresh that they may be cut up and planted out at once. The tops form Crown cuttings, as shewn in the coloured drawings on first page, and the roots may be cut up into short sections. However, the body of the root may be cut up, we have always found that even the smallest pieces germinate.

The plants spread in size of a crown each time they are cut, and the forage may be taken all the year round. It is advisable not to cut the leaves too low—say three inches up. The yield is largest if cut just before the flower opens. The plant likes clay, loam or any deep soil, and the roots will tap down eight feet to moisture. The roots sometimes globe, and hold half-a-pint of gummy water. When preserved in tanks or dried into hay, it is the richest fodder known. A small quantity makes ordinary food palatable.

It is estimated on a clay soil to produce from 60 to 120 tons an acre per annum, when the plants are established, and has been known to yield much above this.

Orders must be accompanied by a remittance if sent DIRECT to THOMAS CHRISTY & Co.

Any of the Branches of the Oriental Bank Corporation. Messrs. KING, HAMILTON & Co., Calcutta; Messrs. KING, KING & Co., Bombay; all branches of the National Bank of New Zealand, Limited; Messrs. HENDERSON BROTHERS, (Anchor Line) London, Liverpool and New York, will receive orders and remittances for delivery of cases on the above terms at the respective ports.

* 2'5" cubic feet.

RICHMOND, VIRGINIA, UNITED STATES.

THOMAS CHRISTY, Esq., London.

10th July, 1876.

DEAR SIR,—All my first Plants are growing beautifully, and I feed my Horses, Cows, Pigs, Rabbits, and Poultry with the Fodder very frequently. This summer is the hottest known for years, but the Plants thrive wonderfully; although we have had no rain for some time. From some of the Plants set out the 11th April, I have cut over Six pounds of leaves, which for such young Plants is good enough.

8th August, 1876.

DEAR SIR,—All the Plants I set out on *dry* ground have grown well, and have shown no sign of withering, although, as I mentioned before, this has been the hottest season ever known in Virginia. There has been scarcely any rain for two months, and the thermometer has rarely been below 95° in the shade, and frequently over 105°.

I am propagating as much as possible from the plants you sent me, and have been setting out all through this hot weather, and have found no difficulty in getting the plants to grow.

I shall be glad to get a few plants of your Solid Stem Comfrey. I imagine the best way would be to send them through the Post, if such a thing is allowed.

31st August, 1876.

DEAR SIR,—We are still without any rain, and everything in the Country is entirely burnt up, *except* my *Symphytum Asperum*, which keeps green, though it does not grow very much now. I have had several persons to see it lately, and they are much surprised to see it doing so well.

In a day or two I hope to send you copy of the *Southern Planter & Farmer*. The Editor came out a few days ago to see my plantation of Comfrey.

Yours truly,

C. E. ASHBURNER.

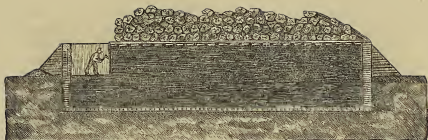
From Southern Planter & Farmer, Richmond, U.S.A., Sept. 1876.

Having heard and read much about Prickly Comfrey, we determined to see it, and judge for ourselves of its value as a fodder plant, that we might be able to give our readers a trustworthy account of it.

A visit which we paid on August the 23rd to Mr. Ashburner's farm in Henrico County, seven and a half miles from Richmond, perfectly convinced us of the extreme worth of the plant which he has imported from England.

As regards its power of enduring heat and drought, we were satisfied by being shown a large number of plants, set out on the 1st, 4th, and 15th of April, which, notwithstanding a total want of rain for several weeks, to which withered corn and parched earth bore witness, showed a fine crop of fresh, green fodder, in many cases weighing from five to seven pounds to the plant.

If we are to make farming pay, we must in these days of free labor and impoverished land, look out for such plants as will require little cultivation and will grow on poor soil. In our opinion, there is no plant as yet introduced into this country, which can compete in these respects with Prickly Comfrey.



PLAN OF PITS AT CHATEAU BURTIN.

The Storage of Fodder has for some time past been exciting much interest, especially in France. Mr. Barral's report to the Agricultural Journal of France speaks highly in favor of *Symphytum Aspernum*, particularly with a view to its conservation (au point de vue de l'ensilage). It is perennial and a very heavy crop producer. It contains an unusually large percentage of Azote or Nitrogen, and gives an early, or I may say the earliest, spring crop on the farm.

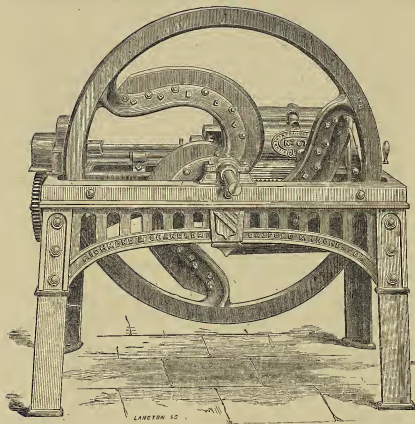
When other crops are ready for cutting and green food becomes abundant, the *Symphytum Aspernum* should still be regularly cut and stored in TANKS or PITS, as a provision against a long summer drought or for winter use.

As the Tank Storage System is so imperfectly understood and almost unknown in Great Britain and the Colonies, I will describe it in detail.

When the French first went to Algeria, they experienced great difficulty in securing forage in the dry season, but by bribing some of the chiefs they learnt the secret of the Arab system of "ensilage" or simply burying the green fodder in trenches, carefully concealed by replacing the earth, and they soon learnt how to trace them out.

The lesson thus learnt in Algeria has not been forgotten, and M. Goffart, of Chateau Burtin, Department Loire et Cher, has of late devoted much time to experiments of this new method of preserving green food and with great success. M. Goffart's experiments have been made with Maize, but the *Symphytum Aspernum* yielding far heavier crops, while its richness, according to Mr. Barral, equals fully that of Green Maize, must be preferred.

With respect to the construction of M. Goffart's pits at Chateau Burtin, the largest—36 ft. in length by 6 ft. in depth and width—has well-pointed stone wall sides, and paved bottom, bonded with cement. A second, adjoining it, is not walled round, but has, like the one just alluded to, vertical sides, so as to facilitate the pressing down of its contents. The largest cost about £11 to make, and frequently contains forty tons of green maize, mixed with about one-fifth of its weight of rye-straw chaff.



STEAM CHAFF MACHINE, WITH SELF-ACTING ENDLESS WEBS.

These pits are worked as follows—As fast as the fodder falls into them from the Steam Chaff Cutter, it is spread out and firmly

trodden by men. When the pit is full, some salt is sprinkled on the uppermost layer, then comes a coating of long straw, and finally a covering of planks well weighted down with logs or stone, not earth for it filters through to the fodder. For some time after the completion of the above work, the pits need to be carefully examined every day, as owing to the settling down of the fodder, cracks are apt to form in the roof, and these, if not closed, would admit a quantity of air, and injure the fodder by turning it mouldy. The same danger is incurred to some extent when a portion of the provender is taken out for feeding purposes, and on these occasions the precaution of covering over the exposed parts again as quickly and completely as possible has to be observed. With regard to the cost of the above operations, as also of reaping, carrying, and cutting up, the total expense is estimated not to exceed 10d to 11d per ton.

M. Goffart's favourable opinion of the system of storing and preserving forage crops in the manner described, is shared by many other French agriculturists who have given it a trial; and it may perhaps be of interest to glance at the reports of two of them—M. Lecouffe and M. Sottom.

That of the former, in a communication to the Lille Agricultural Society, dated Aug. 31, 1876, states that his pits are constructed of brick, built on the slope of a hill to facilitate the escape of moisture, and made broader above than below to prevent the formation of hollow spaces when the food settles down. The exact dimensions of his pits are $4\frac{1}{2}$ ft. in depth by $9\frac{3}{4}$ ft. in width, increasing at the top to $10\frac{1}{2}$ ft., and to exclude the air more effectually, a layer of beetroot pulp is placed above the contents of the pit. His experience with pitted or preserved fodder, both with and without the admixture of straw chaff, has been highly satisfactory, and he strongly recommends its employment in the cattle stall in conjunction with linseed cake, turnips, &c.

M. Sottom, the second gentleman alluded to, writing to the *Journal d'Agriculture Pratique* from Gers, in the South of France, fully indorses the estimate formed of the sour-keep by MM. Lecouffe and Goffart, and has found it excellent food for working oxen. During the last five years he has been in the habit of pitting green maize and sorghum, and he now preserves also, and in the same way, red clover, lucerne, sainfoin, &c.

The greater "proofiness" of the sour food, in the case of sainfoin, lucerne, and vetches, he ascribes to the fact of the crop being allowed to remain standing longer than it would if fed green or made into hay. The coarser woody portions, which, under ordinary circumstances, the cattle would refuse to eat, or which would pass through their bodies undigested, are rendered soft and assimilable by the process of fermentation; and the somewhat acid taste and peculiar penetrating aroma which the fodder acquires cause it to be consumed with avidity. This is especially applicable to India where forage is so liable to become dry and woody. It has been tried and found to answer in England, but too much salt was often employed, and now some farmers are opposed to this common practice of sprinkling salt on each layer in the pit, maintaining that the salt does more harm than good, as it retards fermentation, and renders the lower portions oversalt.

Opinion differs also as to the degree of ripeness the crop should be allowed to attain before being cut; but the leaves and flowers (particularly in the case of comfrey and clover) are never allowed to become so withered and dry that they drop off during transport.

A very succulent crop will heat in the pit, and acquire a darkish colour and disagreeably pungent smell. It was supposed there was less danger, however, to be apprehended from over succulency than from over-wetness; and careful farmers avoided carrying and housing their green food as long as the latter was saturated with rain or dew. But from experiments tried this season when the forage was wet, and gathered in October, 1876, during storms of rain, and cut up quickly and placed in a deep pit in the open air, it has turned out in first rate order and quite equal to that put up in dry weather, opened last week December, 1876. It is of great importance that farmers in Ireland, Scotland, and North of England should note this. Generally speaking, it requires to remain at least six weeks in the pit before it is in a state fit for consumption. As the presence of an excess of lactic acid—the acid to which the sharp taste is due—may cause the sourkeep to act as a purgative, and even bring on diarrhoea, a certain amount of caution is necessary in feeding with it. When, occurring only to the ordinary extent, and the cattle are in a healthy state, no fear need be entertained; the acid then appears to serve the usual purpose of promoting digestion

Experience shows that the deeper the pit, and consequently the greater the pressure on the forage, the better is the quality. A thin partition of stone or brick may be made between the tanks at a small cost, with cross sections or supports and arches in them. There ought to be no filtration of water from the outside.

Two no slight advantages connected with the pitting system are, the economy of labour, and the comparative independence of weather, the farmer adopting it enjoys in harvesting his forage and herbage crops as well as change of diet; and, as remarked by Professor Wrightson in his recent "Report on the Agriculture of Austria-Hungary," this method of storing green food is one well worth the attention of English agriculturists.

PROPAGATION AND MODE OF CUTTING PRICKLY CONFREY SETS.



ROOT-SET.

Root-Set.—This is a section cut off a tap root, and if placed in soil with the small end downwards will throw a large number of heads, which do not always bloom the first year, but yield a large crop. Another plan is, to place the sets in a damp sack kept warm and moist in the dark; shoots are thrown out, and when $\frac{1}{4}$ -inch long the sets may be planted, and the shoots will bloom the first year.



CROWN-SET.

Crown-Set.—This is taken from the root of the plant near the surface of the ground, and the smallest piece forms a crown-set that blooms at once.

THE PRICE OF MILK AND BUTTER

AND HOW

TO SAVE FOUR MILLIONS A YEAR TO THE COUNTRY.

Farmers complain bitterly of the bad times. Let them read the weekly periodicals, such as *The Field, Land & Water*, and other agricultural journals, if they have not time to study the daily papers, and they will get endless hints to take advantage of. Many of the landed proprietors, especially those who are Magistrates, are greatly to blame for their supineness; they read, but won't act—perhaps they do not like to be the first. Take, for instance, Butter. French and Dutch farmers come here and complain that, owing to the English admitting into their country the most abominable mixtures, they cannot command a fair price for *pure butter* in England.

The Agricultural Economist, of December 1st, gives the return of the importation of Butter (so called) for 10 months ending October 1876:—

	1874.	1875.	1876.
Butter, quantity in cwts.	1,344,761	1,230,667	1,398,802
„ Value.....	£7,501,458	7,142,462	8,160,608
Average per lb.	12d	12½d	12½d

It is important to know from one of the first brokers in the Butter trade, what his opinion is on the supply, and the proportion of pure to that of mixed or fictitious Butter, brought here.

Mr. T. W. GREEN, of 5, Catherine Court, London, writes as follows:—“I consider that the proportion of so-called butter which would come under the Adulteration Act is one *fourth* of the quantity imported; it varies according to the time of year. Under competent authorities this importation could easily be stopped and condemned, without loss of time at the port of arrival, where it ought to be at once seized and destroyed.

“The effect of the authorities allowing this article to come into our Ports is to prevent real Butter fetching its true value, and

the money actually passes into the hands of fraudulent foreigners, who dare not offer it for sale in their own countries, under pain of imprisonment without option of a fine. The only action taken by our Government to stop the sale of these poisonous compounds, is to attack and fine a few small shopkeepers, and allow the foreign importers a monopoly.

"14th December, 1876."

This importation must be stopped at once, and by the strong arm of the law, and the owner of land can in justice claim this sort of "PROTECTION" from the Government.

The price of butter and milk will rise in the country, and honest traders here will be benefited by a distribution among them of at least four millions a year. Farmers will seek for the best fodders and find that they need not wait for meadows or grass fields to become established, for they can grow *Symphytum Asperinum* and many other valuable forage plants on the clay lands.*

Messrs. J. L. LYON & Co., of London, large importers of fine Butter from Italy, write me on 20th December 1876, as follows, showing plainly the high opinion of their correspondents in Lombardy on the subject of Prickly Comfrey as a forage plant for their Milch cows.

Nous avons le plaisir de vous annoncer que les principaux fermiers, cultivateurs et négociants de la Lombardie qui nous envoient leurs beurres pour être vendus sur le marché Anglais, nous expriment leur pleine satisfaction au sujet de votre *Symphytum Asperinum*; ils trouvent que ce fourrage a le précieux mérite d'épaissir le lait et que, mêlé au fourrage du pays, il donne un goût encore plus fin au beurre.

Sorghum Saccharatum, or China Sugar Cane, is a plant that answers well for "ensilage" or tanking, the hard stems soften, and the sap is very sweet. It grows luxuriantly in this country and in France, and yields large crops. It is an important plant for India, Ceylon, and our Colonies, where, owing to the heat, a larger proportion of Sugar would form in the cane, but it ought to be cut when say three to four feet high, and it will then break out again; it likes moisture and protection from frost (in this country) in early spring, and yields a second crop.

* Seeds of four new forage plants are in course of collection abroad, and are being tried here and in France. In my next edition I propose to give drawings of the plants and particulars of experiments.

Bokhara Clover (*Melilotus Officinalis* and *M. Alba*), is another plant well suited for pitting—it is a native of Europe and Central Asia, and even in this country lasts for some years if not allowed to grow too high before being cut. It is so aromatic that some people object to use it alone. Cows are extremely fond of it, and this is a crop to replace grain on arable land, and valuable for cattle feeding. Farmers will have to meet the demand for good milk and butter, and the retail price of the former must be raised, as the discrepancy between the price on the farm and that in the city is too great at present.

I have a supply of seed for those who care to plant.

T. CHRISTY, Jun.

It is folly to grow wheat only for the sake of the grain, in competition with America and Eastern Europe, and to continue quickset hedges, when many much more valuable plants can be found, that will yield a return and keep the wind off the stock in the cold months. By a judicious arrangement of plantations laid down by practical men such as Messrs. James Dickson & Son, large tracts of land can be divided off, and these plantations made a source of revenue—by the wood, fruit, and the game—to say nothing of improving and thereby enhancing the value of the estates. Several landowners in Kent, on the bleak hills have determined to try it.

An Agricultural Society in Massachusetts, desiring to encourage tree planting and the re-forestation of poor lands in that State, have lately offered prizes for the best plantation of larch, pine ash, and other trees suited to different localities and soils. The prizes range in amount from 40 dollars to 1,000 dollars, and special instructions are published to guide competitors.

TO PROVE THE VALUE OF UNDERWOOD.—At the recent annual wood sale on the Cale Hill Estate, Little Chart, Kent, the chestnut plantations of ten years' growth reached an average of £46 15s per acre, in prices ranging from £33 10s to £60, while the coppice woods of only nine or ten years' growth averaged £25 5s 6d, ranging from £16 to £40 10s per acre. The land on which the chestnut is planted is some of the poorest in the district, the soil being sandy and growing nothing else.



CHRISTY'S PLANT CASE.

The drawing above represents a Case for transporting worked or grafted fruit trees, forest trees, plants and shrubs that have a firm or rigid stem.

In the year 1862 I invented this case for shipping trees to India and China; the Wardean and Bull cases, shipped on the decks of vessels, entailing an expense for freight and charges in many instances of ten times the cost of such class of trees, to say nothing of the inconvenience to the captain and crew, and their liability to breakage in transshipment. The Peninsular and Oriental Company, always willing to aid our Colonies, at once saw the advantage of these cases, not only to themselves owing to their convenient form, but for forwarding trees in an inexpensive package, and made me a special rate of freight. They have answered admirably, and the Indian Government have transported in these cases a large quantity of forest trees, fruit trees, and vines, to all parts of India.

I have thus established the fact that trees packed when the sap is down can be quite safely transported for voyages of three or four months. By lining these cases with felt, or in some instances tin, an even temperature is insured, and they carry perfectly as ordinary merchandise down in the ship's hold.

Dr. Hooker, at the November meeting, 1876, of the Royal Society, said that when in St. Petersburg at the Scientific Congress, a few years since, he was shown Palms and Eastern plants, accustomed to an atmosphere of 80°, packed closely away in nearly dark rooms, supporting a temperature of 25°, with hardly any artificial heat, for many months in the year, proving that plants can remain a long time in a dormant state.

The rapid strides now made in our Colonies, coupled with the low rate of freight by steamers to all parts of the world, enable these cases to be used to great advantage for transporting worked and trained fruit trees, which can be got here at a very low price, in a compact form like ordinary case goods, direct to the port and then on to the Colonist in the interior, without any fear of injuring the root or head of the plant in transhipment.



This sectional drawing only shows a few holes in the partition; about 50 small trees may be packed at the end of a case. In packing these cases of trees, great care must be taken that when the packer cuts the holes for large stems in the screen or partition that he places thick felt between the wood and the stem, or else the bark will rub.

Again, trees ought to be chosen that have been regularly moved and have small roots. Fine dry loam must be most carefully shaken and worked down between the fibres of the roots, in the compartments A and B, so as to avoid bruising them as much as possible and allow no play for shrinkage. Another plan is to run in fine moist loam mixed with dried (not green) moss. Although any nurseryman with a *large* stock, who can select a quantity of trees with suitable tops and roots, can employ these cases, nevertheless Colonists who wish to avoid disappointment will find it to their advantage to pass their orders to experienced houses. I shall be very glad to assist any correspondents in placing their orders, and lists of trees will be found in this book.

I have letters from many people expressing the pleasure they experienced when they found themselves surrounded by rose trees, vines yielding such large grapes that they were only accustomed to see at the shows in England, and fruit trees laden with delicious apples, pears, oranges, and lemons. The two last-named fruit trees will do well in many of our Colonies, and they support occasional sharp frosts, for there is a great difference between a continuous frost and a sharp frost for a few hours towards the morning, such as experienced in India and North of China.

For soft-wooded plants, orchids, &c, I recommend the case patented by WILLIAM BULL, Esq., F.L.S., a drawing of which is shown in this book.

T. CHRISTY, Jun.

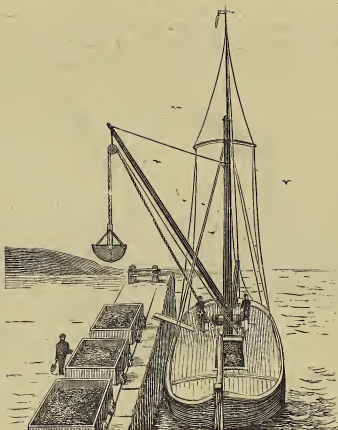


Plate No. 1 shows a barge unloading fine material, such as ashes, dust, grain, earth, or ballast. The two chains are worked by a hand winch placed in front of the mast. This plan is only adopted by barge owners when they have not got a steam crane on the wharf. The bucket is entirely self-acting, and under the control of the man at the winch. They can when coming up the river empty, dredge up a cargo of ballast at any state of the tide.

SELF-ACTING BUCKET.

For some years there has been successfully working in America, a very simple machine, which almost any village blacksmith can keep in order and repair, and no doubt, owing to its being employed in out-of-the-way places, has almost escaped the notice of Engineers in this country; I say almost, because it has been successfully employed in harbours in Northumberland, and Scotland, and a few other places. In America, with two men, it has dug out many Canals and Docks, and landed the excavated material on the bank.

By a reference to the engraving herewith it will be clearly understood that this machine for excavating Canals, Reservoirs, or making Embankments is invaluable, as it is independent of Coffor Dams.

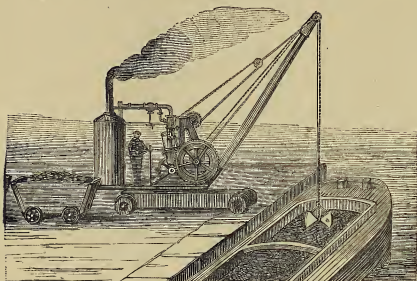


Plate No. 2.—Represents a steam crane on a wharf, loading waggons from a river barge. A skilled engine-driver can clean out a barge with these self-acting buckets, not leaving 1 cwt. of dirt if he can only see the barge he is emptying. By using the grab in place of a bucket he can discharge or load stone, coal, &c., and with the self-acting fork he can lift manure and other light substances.

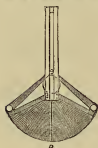
The self-acting Bucket is also employed for loading and discharging lighters, as it will pick up the finest material, if even in a liquid state like river mud (see fig. B), or cut the weeds in a river and place them on the bank. Of course the size can be varied, from a 4 cwt. Bucket worked by a hand-winch, up to one of 2 tons, equal to two cubic yards of earth, worked by a steam winch or engine.

The self-acting Buckets are made with a straight or curved cutting edge for ordinary loose soil, with short teeth fitting into one another for cutting through clay or gravelly soil, and with strong tines, called a grab, for picking up rocks under water after explosions by batteries, where it entirely dispenses with the costly operation of a diver slinging the stone or debris of rock.

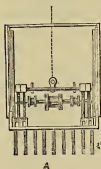
To ascertain how quickly a Canal can be cut or a Reservoir dug, it is only necessary to calculate the number of cubic yards to be

excavated, then how many trips the dredge can make per minute, and the elevation at which the mud has to be deposited; this calculation is also influenced by the depth to which the chains have to be let out, or the soil extracted from.

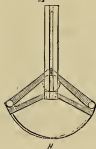
It may be some guide to state, that a Bucket holding a cubic yard or ton makes in America two to three trips per minute: that is to say, excavates two or three cubic yards per minute. As it is not influenced by tide or the movements of the craft, sand may be excavated at any hour of the day or night, or at any state of the tide. With this machine farmers can secure the mud, which is so valuable for their crops, from the bottoms of reservoirs, ponds, or rivers at a comparatively trifling expense, or load it at once into their carts instead of leaving it by the side of the water.



B shows the self-acting bucket closed; one chain lowers it open on to the ground, and on the cutting edges being set in motion by the lifting chain, the whole force is so exerted for excavation and filling the bucket with the assistance of its own weight, that it does not rise until the edges come together, or in the case of stone or rock until the pieces are firmly held.



A shows a self-acting machine fork for farmers. It is very light—a 4 cwt. one can be worked with a rope on a gibbet by men or a horse from a beam, or by a steam crane, as shown in plate 4. This works on the same principle as the bucket B, and the same frame can be made to serve for bucket or forks.



H is a side view of the same self-acting machine fork, which will be found extremely useful on Estates for emptying the manure tanks. Should the chains or ropes be found to twist, a thin rope can be employed to guide the bucket when filling and discharging itself.

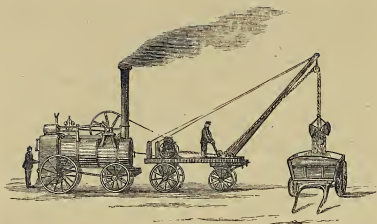


Plate 8 is an engine working a portable winch and gib, such as is used for cleaning rivers and reservoirs and loading manure, and can be worked at a wharf where there is no fixed steam crane.

Having heard from several farmers what difficulty they now experience in getting men to empty yards, sufficiently turn dung clamps, and so prepare the manure for the land, I determined to adapt this very useful machine to agricultural purposes, as shown in Plate 3—the agricultural cart, with winch worked from an engine, and the two chains passing over a light gib or crane. In this way it works with the bucket when small stuff is moved, and with the light steel tines fitted on a frame, a farmer with his engine can turn his dung clamp easily at the rate of 2 tons per minute, and what is also of great importance, instead of his piling his manure by the side of a ditch, or in a lane exposed to the sun and rain, whereby he loses many of the valuable properties of the manure, he can now excavate or puddle a large tank or reservoir, which will hold his manure, give him a supply of liquid manure for irrigation, and when he requires to place the manure upon the land, he can with this machine-fork load his carts, as rapidly as he pleases, with an ordinary unskilled labourer.

Good farm-yard manure is admitted by all authorities to be of the highest value, and will be much more thought of and studied, now that it can be removed so easily. A small farmer can do his work by simply having a self-acting bucket or tine fork to hold 4 cwt. and work it from a portable gibbet by two men, or a horse, with ropes. Farmers with engines will be able to utilise them by letting their engineer and one man go out and take work at so much per ton or yard.

Any crane can be altered and adapted for the two chains. If the chains are found to twist, a guide rope or chain can be attached to the bucket, or wood guides can be run from the frame-work of the bucket.

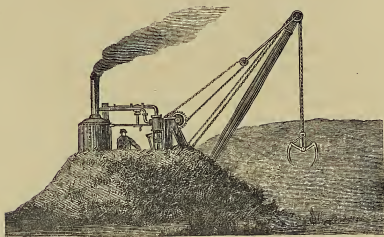


Plate 4.—A steam winch, working a self-acting machine-fork for manure. It will turn a manure heap or load carts, at the rate of two tons per minute.

The Report of the Council of the Royal Agricultural Society furnishes the following estimated value of the manure obtained by the consumption of different articles of food, each supposed to be of good quality of its kind :—

No.	Description of Food.	Money value of the Manure from one Ton of each Food.			No.	Description of Food.	Money value of the Manure from one Ton of each Food.		
		£	s.	d.			£	s.	d.
1	Cottonseed-cake, decorticated	6	10	0	16	Oats	1	15	0
2	Rape-cake	4	18	6	17	Wheat	1	13	0
3	Linseed-cake	4	12	6	18	Malt	1	11	6
4	Cottonseed-cake, not decorticated	3	18	6	19	Barley	1	10	0
5	Lentils	3	17	0	20	Clover-hay	2	5	6
6	Beans	3	14	0	21	Meadow-hay	1	10	6
7	Tares	3	13	6	22	Bean-straw	1	0	6
8	Linseed	3	13	0	23	Pea-straw	0	18	9
9	Peas	3	2	6	24	Oat-straw	0	13	6
10	Indian-meal	1	11	0	25	Wheat-straw	0	12	6
11	Locust-beans	1	2	6	26	Barley-straw	0	10	9
12	Malt-dust	4	5	6	27	Potatoes	0	7	0
13	Bran	2	18	0	28	Parsnips	0	5	6
14	Coarse Pollard	2	18	0	29	Mangold Wurzel	0	5	3
15	Fine Pollard	2	17	0	30	Swedish Turnips	0	4	3
					31	Common Turnips	0	4	0
					32	Carrots	0	4	0

This table gives a correct chemical estimate of the comparative manurial value which the various kinds of feeding stuffs, after they

have passed through the body of the animal, would possess if the whole of their fertilizing constituents could be incorporated with the soil without loss.

In most cases, however, a certain loss, differing in amount according to a great variety of circumstances, will occur.

Thus, when the food is consumed upon the land by sheep, the loss will be small. On the other hand, if cake or corn is consumed in open yards in a district where the annual rainfall is excessive, and where, on account of scarcity of straw or other available litter, the manure produced is made under very unfavourable conditions, a large proportion of the soluble and most valuable constituents of the dung will run to waste.

The loss due to the removal of the most valuable soluble manure constituents of food by heavy rainfall, is more considerable than the loss by evaporation in this country, and hence the manure produced under cover will be more valuable than that made in open unsputted yards, where much of the soluble fertilizing material is washed out. In other localities, where the rainfall is small, and in some cases barely sufficient to make the straw and cattle excrements into manure, little or no appreciable loss in fertilizing elements is experienced, although it may be made in open yards; if moved into open tanks it will neither evaporate or waste away.

When the manure is produced in boxes in which fattening stock are copiously littered with cut straw, the loss in manuring matters is less than when made in yards with long straw.

This self-acting manure-fork enables the farmer to move the manure at a low price, and to know it is well made, and that he can get it out of the tank whenever he requires it.

T. CHRISTY, Jun.

A 5 cwt. bucket costs £18 10s; a 10 cwt. do. costs £28; a 20 cwt. do. costs £45.

A 5 cwt. tines costs £17 15s; a 10 cwt. do. costs £27; a 20 cwt. do. costs £42 10s.

A 5 cwt. hand-winch, with 2 barrels complete, £22 10s; a 10 cwt. do. £24.

A 5 cwt. gibbet with ropes, worked by horse or men, £21 10s.

Agricultural cart with winch and jib, to work by hand or by a belt from a portable engine, £69.

A 20 cwt. steam crane, with all engine and boiler power complete, on a four-wheeled bogie, with wrought iron jib and two barrels for working the bucket or tine grab, £357.

Best Crane Chain.— $\frac{1}{16}$ in, per fathom 5s 6d; $\frac{1}{8}$ in, per fath. 7s 6d; $\frac{3}{16}$ in, per fath. 10s.

Drawings sent with orders when executed, and full particulars furnished upon application to THOS. CHRISTY & Co.

PART II.

SUBSTANCES CONTAINING TANNIN, AND TAN-TESTING APPARATUS.

For a long time past Chemists have been vainly searching for the best means of arriving at the exact amount of tannin contained in any given bark or extract. Science has not yet been able to fix for certain the quantity of pure tannin contained in bark which has been analysed ; the reason is, that the re-active agents employed up till now entail in their precipitating action, (in more or less abundance), properties foreign to tannin, such as vegetable acids, and resinous, saccharine, azotic matters, &c.

Nevertheless, after analyses made by distinguished chemists, it has been found possible to arrive approximately at the quantities of tannic acid contained in the substances commonly used in tanning. However, these tests always involve much loss of time and great expense.

When a tanner is about to make a purchase of bark or extract, he requires to have ready to his hand an instrument which enables him promptly and easily to test the samples. To await the result of a chemical analysis is often very difficult, and always takes too much time, and could only be done in the laboratory.

The rise in the price of oak bark, which is the standard substance with English tanners, brought several foreign substances and extracts into the market, and there was really no satisfactory test for either the tanner, the broker, the merchant or the exporter or manufacturer of the extracts.

Professor Muntz of the *Arts et Métiers*, Paris, lately invented a very simple machine, which can be used in any country. With its aid the tanner can find, in twenty minutes, the exact commercial value of any substance, and its working is so simple that an inexperienced clerk or assistant may make the test. The result is arrived at, by comparing the amount of tannic acid shewn by this machine

with the known values of such articles as valonea, divi divi, &c. &c., in the price lists.

At the end of this chapter will be found a drawing of the machine, with full directions for use, and letters, testimonials from Professors and Tanners who regularly employ it for their tests.

It is most important that merchants living abroad should turn their attention to the subject of new materials containing tannic acid. Owing to the increase of population and the demand for tanned leather by countries in course of civilization, coupled with the slow growth of the oak and the short supply of tanning materials, any new vegetable, bark, or fruit containing tannin, must come into demand and become a regular article of commerce, the value of such materials being accurately determined by this machine.

It will be of interest to see what at present is being done with tanning substances.

BARK.

That the bark is the portion usually selected by tanners, need occasion no surprise when one reflects upon the important office which it holds in the vegetable economy. It is the laboratory in which is completed the elaboration of the nutritive qualities absorbed by the root. From these absorbed substances some transude to form the bark itself, while others remain within to build up the plant. Among these substances, tannin is one of those which like fecula, gum, sugar, pectine, and mannite, are most constantly found. Experiments have demonstrated the correlation which exists between these various substances, and how it is possible, up to a certain extent to transform one of them into another, even while in the vegetable organism, as easily as with the apparatus and the re-agents of a chemical laboratory.

The barks most commonly used by tanners are obtained from trees belonging to the families of the Amentaceae, the Salicinae, the Legemimosae and the Coniferae.

In the great family of Amentaceae we first come to the corilacae cupuliferae, in which are found the oaks, whose bark may be taken as a type of tanning substances, not so much on account of the quantity of tannin which it contains, as because of the high quality of leather which it produces.

The sweet-glanded oak is a variety of the holm-oak, which is found chiefly in Spain and Algiers. It is valuable not only for its bark, but also for its acorns, and often furnishes food to the inhabitants of those countries.

It is probable that by some manipulation, the wood of this tree might also be utilised. There is a variety of this species, which grows in the South of France, between the Adour and Bayonne, called by the natives *Corcier*; it differs from the preceding in being more hardy, and in ripening its fruit only once in two years.

As examples of profitable oak-bark growing, the Report of the Chamber of Commerce of Nordhausen (Prussia) instances the wood of Rottleberode, on Count Stolberg's estate near Nordhausen, where a 15 years' rotation is observed, and the bark stripped by the owner, with an average yield of 1,500 cwt. per annum; and a portion of the Crown forest of Hoheberg, near Saugerhausen, where a 12 years' system is followed, and the bark stripped by the purchasers, with an average yield of 500 cwt. per annum.

English Oak bark claims our first attention, in its different ages of growth going under the names of coppice, store, flittern, and timber bark. The youngest, coppice, contains a large proportion of extractive matter, which tends to mellow the action of the tannic acid. At this stage a picked sample, which has little or no epidermis, will yield as much as 12·35 per cent. tannic acid.

OAKS— 50 years old yield 8·90 per cent.

70 years old „ 6·12 „

In certain localities, as the trees grow, the rough exterior epidermis thickens rapidly, lessening year by year the value of the bark. No other tanning material with which we are acquainted can occupy the same position as oak bark, possessing in itself all that is necessary to make a good tough wearable leather. But the enormous increase and development of the trade soon proved that unless other materials of greater strength and more speedy action were discovered, leather could not be produced in sufficient quantities to supply the demand.

Various substances have been imported; among the foremost we must place *Valonea*—the acorn cup of the *Quercus agrilops*,

and Turkey oak, growing on the northern shores of the Levant, Smyrna being the principal port from which it is exported.

In 1830 we imported 86,538 cwt.; in 1875 England received 24,131 tons. This year we have a large crop, but some of it is affected by a species of honeydew, not unlike that found on of the hazel and lime trees in England. Such honey-dewed valonea only gives from 12 to 18 per cent. of tannin.

The Morea, Islands of Greece, and many of our Colonies are well adapted to the growth of this description of oak, which, with a little care and attention in planting, would, without doubt, yield handsome profits to growers, for 30 to 35,000 tons, is all that is raised on the average of many years. A good sample of Valonea gives 34 per cent. tannin. It imparts great firmness and weight to leather, and in the process of tanning deposits a considerable amount of what is technically known as *bloom*. This deposit was at one time considered essential to all good leather.

Myrabolanes, the fruit of the *Terminalia cherbula*, closely allied to the myrtle. Our dependencies in Bengal and Bombay furnish us with considerable quantities, and in 1867 we imported 3,000 tons; in 1874, 8,714 tons. The fruit contains a kernel, or stone, possessing no tanning properties. Myrabolanes gives from 20 to 40 per cent. tannic acid. Leather tanned exclusively with it has a yellow colour, but is soft and mellow in working.

Mimosa bark, *Acacia dealbata*, is imported from Australia. The supply appears inexhaustible. The bark is a hard close texture, and red in colour, giving about 24 per cent. tannic acid. The extract was imported into our country fifty years since; but it is only within the last fifteen years that it has been looked on with any favour. The objectionable colour which it imparts to the leather, has created a prejudice against it.

Sumach, *Rhus coriaria*, known as such by the Romans, a deciduous plant growing in the south of France, the Morea and Sicily. It comes to us in the form of a powder, obtained from the ground twigs and leaves of the bush. Palermo exports nearly 12,000 tons yearly; but little leather is tanned exclusively with it. It is employed rather as a useful addition, correcting much of the harshness and colour of other things. The better qualities give 18 per cent. tannic acid.

Divi Divi, *Cæsal pinia coriaria*, the pod of a leguminous plant, indigenous to the coasts of Venezuela and New Granada. The tree grows to the height of twenty feet; but I am not aware that it is in the least cultivated. The dried pod has a burnt appearance, often twisted into the shape of letter S. The quantity which reaches our country is about 29,000 tons yearly. It yields from 40 to 50 per cent. of tannic acid.

Terra japonica, or gambier, the dried extract of the shrub *Acacia gambii*, grows on the southern shores of Asia. Rhio, distant about thirty miles from Singapore is the port of export. It yields, according to Muntz, 40 per cent. tannic acid. In 1824 we imported 4 tons 9 cwt.; in 1875, 13,700 tons. Other countries draw also largely from Singapore. A great prejudice arose in the minds of the majority of Tanners against its use, from the objectionable colour and from its weak affinity for gelatine, giving it more the character of a dye.

Could not chemistry come to the aid of the tanner in the preparation of the gambier at Rhio, and could not the catechuic acid be precipitated without injury to the tanning properties of the material, so as to send us home only the tannin?

Tormentil roots were used about one hundred years since in the Hebrides for tanning purposes, containing 31 per cent. of tannic acid.

Hemlock extract, *Abies canadensis*. This is brought to England in casks from America, with about the consistency and colour of treacle, according to Muntz, giving 25 per cent. of tannic acid. Being one of the latest introductions, great variety of opinion is expressed as to its value.

The small gall-nut of the *Tamarix* tribe, growing in Morocco and British India, giving 40 per cent. tannin, is remarkable for its purity. Larger quantities will, we hope, be shipped, as its value becomes more known, (£40 per ton if clean) and the supply is inexhaustible in British India.

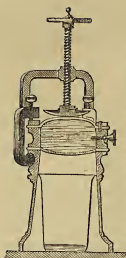
Amongst the Colonial exhibits at Philadelphia, was a collection of New Zealand barks, comprising specimens of *Fuchsia excorticata*, containing 5·3 per cent. of tannin, *Eugenia* M 16·7 per cent., *Elæocarpus* Hooker 9·8 per cent., *Coriaria rustifolia* 16·8 per cent., *Knightia excelsa* 2·7 per cent., *Eloetocarpus deatatus* 21·8 per cent., *Weinmannia racemosa* 12·7 per cent., *Myrsine urvillei* 1·4 per cent., *Phyllocladus tricho manoides* 23·3 per cent.



Full-size of flower
BALSAMOCARPON
Casalinea brevifolia,
 Algarroba and
 Algarrovia.
 (Chilian name.)

BALSAMOCARPON is a new tannin gum of great strength, and when taken pure from the pod or bean yields 80 per cent. of tannic acid. It is entirely new to both commerce and botany, and the first plants ever propagated in England were given by THOS. CHRISTY in 1875 to the Royal Gardens, Kew. A supply of the seed from Chili has been distributed through India, Ceylon, and some of our Colonies. The leather made, with only the assistance of 25 per cent. of this gum in the tannery of Messrs. Hepburn & Co., of London, was equal to the finest oak-bark tanned hide, and yet it was completely finished in one-third of the time required for the same quality of leather. It will grow well in Australia. The pods must be picked before the rainy season, as the gum melts with the wet, and the pods fall from the tree and become of little value, losing 50 per cent. of their tannic acid.

THOS. CHRISTY, Jun.



This drawing represents the Muntz Tan Tester, made solely by Messrs. THOMAS CHRISTY & Co., of 155, Fenchurch Street, London. It is supplied in a wooden case, at Four Pounds sterling complete, with all necessary apparatus. It will therefore be seen that this machine can be had at such a price as to be within reach of all, and its mechanism is so simple that no instructions are required beyond the following. Before shipping any new material the value can be arrived at by the merchants abroad.

DIRECTIONS FOR USE.

For BARK select half-a-pound of the tanning material, to represent the average; this grind in coffee mill; then weigh of the powder from $2\frac{1}{2}$ to 20 grammes [see * next page]. Place the-weighed powder in clean Florence-oil flask, adding to it 100^{cc}. of cold water; this to be well mixed, and allowed to stand a few hours. The contents in flask to be boiled for five minutes (this can be effected over Bunsen's burner or the flask immersed in small saucepan of boiling water). The solution to be filtered through filtering paper. Temperature of liquor brought to 60° Fahrenheit. The density of liquor to be taken with small Tannometer, note being made of the same.

Take a piece of thinnish hide, which has been unhaired and fleshed; this should be free of lime. Squeeze out all superfluous water, place the piece of hide (flesh uppermost) on the base of machine, put on the cover, close up side claws and screw them down, fill the chamber with clean water and force it through the skin, then undo the side screw and empty out any water that may remain between the pieces of hide. Pour in the liquid through side-opening, placing in securely the screw stopper; put on pressure by turning the screw, the liquid will be forced through the skin drop by drop into glass below. When sufficient has been collected, the liquid

must be poured into the small cylinder and again tested with hydrometer, the difference between the two densities shows the percentage of Tannic Acid in the substance. This difference is multiplied

By 40 if	$2\frac{1}{2}$ grammes of stuff	are put to	100 ^{cc.} of water.	
" 20 "	5	"	"	100 ^{cc.} "
" 10 "	10	"	"	100 ^{cc.} "
" 5 "	20	"	"	100 ^{cc.} "

For instance, if the Tannometer marks for the first liquid 2·8 and for the second 1·3, the difference 1·5 or $1\frac{1}{2}$ degrees must be multiplied by 40 if you have taken $2\frac{1}{2}$ grammes, which gives 60 per cent. Tannin.

20	"	"	5	"	"	"	30	"	"
10	"	"	10	"	"	"	15	"	"

For Extracts you weigh a certain quantity, which varies according to their richness in tanning properties, and dissolve it in water, and pass this solution through filtering paper before you gauge the first degree of density.

- * For English Bark { say take 20% or 308·68 grains English to 100^{cc.} of water
- * For African Bark { say take 10% or 10 grams. (154·30 grains) to 100^{cc.} of water.
- * For Valonea, Miller's extract, Divi Divi and Myrabolanes { say take 5% or 5 grammes (77·17 grains) to 100^{cc.} of water.
- * For materials such as Balsamocarpon, Dry-Chestnut-extract, which contain more than 60% of Tannin { say $2\frac{1}{2}$ % or $2\frac{1}{2}$ grammes (38·58 grains) to 100^{cc.} of water should be taken.

This figure of 100 grammes of water is not obligatory; but this quantity is sufficient for our *small Tan Testing Machine*, which is constructed to make a very accurate and rapid test. By reading carefully these figures, it will be seen that any weights or measures may be employed, as they are decimals.

Instruments supplied with Tan Tester :—

Small Hydrometer or Tannometer in case ;

Large Glass Cylinder on foot, with mark cut at 100 cubic centimeters ;

Small Glass Cylinder, for use with Tannometer or Hydrometer after the liquor has passed through the hide ;

Glass with lip for receiving the liquor as it drops from the skin ;

Glass Funnel.

A French 5 cent. or French halfpenny weighs 5 grammes

" 10 cent. or French penny " 10 "

To get $2\frac{1}{2}$ grammes, weigh 5 grammes and put half in each scale.

One gramme = 15·434 grains.

CHEMICAL DEPARTMENT,
MUSEUM, OXFORD,

DEAR SIR,

UNIVERSITY OF OXFORD.

Having had ample opportunity of testing the efficiency of your Apparatus for the estimation of strength of Tanning materials, I am able to forward you an opinion as to the results obtainable by its use. The analyses are conducted with ease and rapidity, and, according to my experience, with much greater accuracy than by the old gelatine volumetric method, the average variation between any two analyses being about 0.5 per cent.

Perhaps the most important advantage obtained is, that from a clear solution of any tanning material the total weight of substance capable of being absorbed is reckoned, and thus the actual *leather-producing power* of the material obtained. Whether this value be wholly due to tannic acid or not, it is certain that the percentage in some instances differs considerably from that obtained by estimation with gelatine. This is more especially the case with Gambier and Cachow, both of which with your Apparatus give over 40 per cent., while Gambier gives with gelatine about 20 to 25 per cent. and Cachow about 30 per cent.

I find the results by your Tannometer agree very sensibly with the numbers afforded by Hammer's Table, and by evaporation before and after the removal of the tannin, of course rapidity is very much in favor of the Tannometer.

	By Density and Equivalent from Hammer's Table.	By Muntz Tannometer.	By Evapor- ation.	Remarks.
Cube Gambier	41.45	40.44	*47.43	Best quality.
Bale Gambier	42.54	39.5	*49.02	Good quality.
Cutch (Cachow)	47.7	44.6	*53.16	Good quality.
Valonea	25.32	25.17	26.3	Medium quality.
Myrabolanee	32.30	30.28	31.08	Medium quality.
Mimosa Bark	31.44	30.18	31.72	Poor quality.
Green Galls	53.4	52.41	*57.9	Best.
Blue Galls	60.6	59.1	—	Very best.
Hemlock Ext. (<i>Abies Canadensis</i>)	25.14	25.0	24.73	Very best.
Sumach	17.10	18.90	19.55	Medium quality
Divi-Divi	34.5	33.95	35.2	Medium quality
Rampacher's New Material	—	50.0	—	

I am, Dear Sir,

Faithfully yours,

(Signed)

JOHN WATTS.

July, 1875.

* Too high.

BRIDGE TANNERY, BEDMINSTER, BRISTOL,

C. B. MAY, Esq., Marlborough.

December 18th, 1875.

DEAR SIR,—Very few Tanners are able to analyze the different Tanning materials which they employ in their business, and to those who are proficient in these matters, the testing of Tanning Agents accurately is a more or less troublesome affair.

Not long since I heard of a new machine, which in its action forces the solution of the Tanning Agent through the pores of the skin, in fact, doing on a small scale what we are accustomed to do more slowly in a large way in the tanyard.

I am glad to be able to testify that the machine is a perfect treasure to any Tanner, and must necessarily soon be in common use.

I wrote to THOS. CHRISTY & Co., who were entire strangers to me, three months since, saying how pleased I was with the machine.

Myself and friends have been able to rectify serious mistakes, and in fact, we are now enabled to learn the real value of the substances we employ.

An ordinary piece of belly of English or foreign hide, taken from the rounding table, and *clear* of lime with glucose, is the best medium for working in the machine, and it is important to remember that the flesh side must be uppermost, or the experiment will fail. I should be pleased to give information to any one as to the right mode of working the Tester, and feel assured it only needs to be known and properly applied to be considered a boon to the Tanner and the dealers in Tanning materials.

Great credit is due to Mr. John Hepburn, Jun., for at once encouraging the introduction of this machine, and placing it in the hands of Professor Watts, of Oxford, whose report is very interesting.

The opinion of Professor Stoddart, of Bristol, warrants every confidence being placed in these Tests.

W. N. EVANS.

BEDMINSTER, BRISTOL,

MESSRS. CHRISTY & Co.

November 21st, 1876.

DEAR SIRS,—The Tantester which I had from you is of essential service in estimating the value of all the Tanning materials we require,—this year especially, when there is so much common, inferior and doctored Valonia to be met with in the market. Only last week I was offered some re-dried Valonia, which was said to contain 28 to 29 per cent. of Tannic Acid. On the sample being opened, it certainly was very dry, but the color was execrable; the smell very sour. This was tested with Muntz's Tantester, and twice shewed plainly that it contained barely 14 per cent. of Tannin, and the color which it imparted to the piece of skin was quite black. This is another advantage in the use of the Tantester, after the skin is removed from the machine, a sharp knife can divide it, when it will shew very plainly the color which the Tannin Agent has imparted. This is of equal importance, as to know the strength, color being so much a test as to quality. It is but fair to say that the wholesale dealer who supplied me with the sample of Valonia, gave his percentage of strength second-hand. A Tanner had bought 80 tons of this rubbish, and was under the assurance that it contained 29 per cent. of Tannin. Your machine I use constantly, and the more it is used, the more I am convinced it is almost perfect as a Testing Machine, and most readily employed.

I beg to remain,

Yours faithfully,

W. N. EVANS.

Extract of Letter, in the Tanners' Journal, from
Mr. H. R. PROCTOR, North Shields.

October, 1876.

My object in making these experiments is to arrive at a method of tannin analysis. This I do not yet believe the tannometer to furnish, but on the other hand, I think it valuable as a rough test, and far superior to the barkometer, if not the best method in use.

REPLY.

SIR,—After the kind manner in which Mr. Proctor treated my comments on his paper bearing on Muntz's Tan-tester, I feel a little delicacy in taking up my pen, to answer his last reference to it. No doubt Mr. Proctor was right in concluding that the borax must needs be all removed from the pelt before the skin is in a fit condition for testing purposes. I always fill the machine with water, which is forced through the pelt previous to testing.

Mr. Proctor employed 10 grammes of chesnut extract. Five grammes is the right quantity, as was proved by experiments B and C, which gave relatively 17.0 and 16.2 per cent., tannic acid passing through in both cases. It is quite clear to me that if 5 grammes of the extract had been used instead of 10 grammes, the result would have been very different—each test would have stood at 18.5 per cent. Mr. P.'s second experiment I look upon in the same light. As my experience of the machine, now extending over some year or two, constantly in use, more than ever confirms me in my original opinion, that if the piece of skin be of *sufficient substance*, and properly clear of borax, that no tannic acid will pass through. I invariably test the filtrate with gelatine and acetate of copper, to detect the presence of tannic acid. I have never found a trace of tannin except when the quantity of tanning agent was too much for the skin to carry, or when the piece of skin was too thin for the purpose. Finally, I would say, the machine will enable any tanner to find with considerable accuracy the real amount of tanning properties in any material which go to make leather. Lowenthal's method will not do that. Apologising for my second comment.

I remain, yours faithfully,

W. N. EVANS.

THE NEW LIBERIAN COFFEE

"Coffea liberica."

THIS new plant is now attracting considerable attention in all Coffee-growing countries. Its many desirable characteristics are making it anxiously sought after, notwithstanding the firm hold so long established in popular estimation, and on the market, in favour of the ordinary *Coffea arabica*, in the New as well as in the Old World.

Liberia being a comparatively unknown region, coupled with the entire absence of commercial enterprise in that part of Western Tropical Africa, and the want of better knowledge, has allowed this finer and more robust species of Coffee to remain practically unknown to the marts of the World.

At length however, greatly through the enterprise and exertion of WILLIAM BULL, F.L.S. of King's Road, Chelsea, London, a considerable number of young plants of this new Coffee have been brought here from Liberia, and exported to those countries where Coffee-growing forms the staple industry.

The attention of merchants and commercial men has been drawn to it, and a wonderfully important change, amounting to almost a revolution in this trade, is apparently about to be effected.

From all that is known of this new product up to the present time it is anticipated that it will prove one of the most useful and remarkable additions to commerce of the century; for, besides being amazingly prolific, the fact of its being so superior in flavour to the best selections of the ordinary Coffee must make its marketable importance very great and the demand for it immense.

The prolific character of the Liberian coffee is remarkable in comparison with *Coffea arabica*. A well known Coffee planter went especially to Liberia to judge for himself of the commercial importance of this new product; and, in a letter to the *Ceylon Observer*, he writes as follows:—

"An estate of 20 or 30 acres well looked after would yield as much Coffee as one with 200 or 300 acres of *Coffea arabica* or Ceylon. Coffee berries are like plums, as big. The unpruned Coffee has no leaf disease."

Merely being prolific, however, would not establish the reputation for this Coffee in the markets of the world which it will surely

command. It will be due in a great measure to its delicious flavour, and so high is that excellence that for some years to come it may be expected to realise, weight for weight, two or three times the price of the best qualities of ordinary "*Coffea arabica*."

Papers relating to the cultivation of Liberian Coffee have lately been laid on the table of the Legislative Council of Ceylon, and they contain the following particulars, made up from information gathered in Liberia:—

"The Liberian Coffee grows equally well in the immediate neighbourhood of the sea, and at considerable distances from it;"

so that whole tracts of land will, in various countries, now become valuable for Coffee growing, which have hitherto been unsuitable for that purpose, as "*Coffea arabica*" could not be cultivated to produce a paying crop except at a certain elevation.

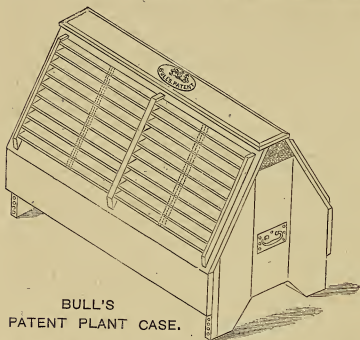
The paper referred to remarks—

"The first crop is generally only a few berries, but the tree goes on increasing until it becomes capable of yielding 20 pounds. We have heard of trees giving 24 pounds each; those are very old trees. More generally depends upon cultivation than upon age. The tree grows to a height of twenty feet or more; we have seen one more than thirty feet in height, this was in the woods near an old plantation. Some cultivators top their trees, others let them grow up *ad libitum*. Our trees are topped at a height of five feet. Trees that are topped are more conveniently picked, and other things being equal give a larger crop; when the trees grow up tall, moreover, they are frequently injured by climbing with ladders, and pulling down the limbs, &c., and as the tree ripens its crop and blossoms for the next year, at the same time, much of the blossom and young fruit is rubbed off the tree; whereas, the low trees are picked by standing on the ground. With us the Coffee plant is not a shrub, it is a forest tree. There are trees here forty years old, flourishing in all the vigour and verdure of youth, and bending down under their weight of berries. We have seen a few of these old trees, when cut down, shoot up more rapidly and more vigorously than when first planted from the seed."

Plants of this new Coffee can be supplied in quantity by Mr. William Bull, and sent safely to any country in his Patent Plant Case, of which an illustration is annexed. The plants for export are kept in small pots, which are fixed in the cases with battens, so that when they arrive at their destination, they can be taken out of the case and removed from the pots without receiving any check.

Foreign Governments interested in the advancement of the culture of Coffee, as soon as they heard of this new variety, sought to

obtain supplies direct from Liberia, but after failing to do so, they applied to Mr. W. Bull to send them established plants in his Patent cases, which safely reached the plantations. Advices have already been received that its culture is creating great interest, even beyond our own Colonies, and planters see every reason to expect it to return them a rich harvest and to prove a great financial success.



BULL'S
PATENT PLANT CASE.

It may be worthy of remark to say that Mr. Bull's Case was not patented merely to import and export this new Coffee, although it has proved highly useful and of the utmost importance for that purpose; but being a plant and seed merchant, accustomed to import and export annually tens of thousands of plants of various kinds to and from nearly all parts of the Globe, he for that object designed and patented the above Case, as he found the necessity of a more secure mode of packing. His establishment, at King's Road, Chelsea, is a vast emporium of plants of various kinds, of the most beautiful and rare descriptions, as well as plants of importance for the advancement of commerce, and these are being

continually added to by his own collectors, sent out for the purpose of exploring little-known and unknown countries, and by the constant accessions from various foreign correspondents.

Mr. Wm. Bull is now introducing other plants suitable for British India and hot climates, of the utmost official importance, their products being of great commercial value. An account of these will be given in later editions of this book.

Foreign orders for plants, seeds, &c., are selected and packed with the greatest possible care in Bull's Patent Plant Cases or close boxes, according to the nature of the goods, and dispatched by the best routes, mail steamers, clipper ships, and railways, to any part of the world; and it is gratifying to know that the most satisfactory accounts are being constantly received of the excellent condition in which both the plant and seed orders, entrusted to Mr. Wm. Bull reach their destinations.

Especial care is taken in the seed department of Mr. Bull's establishment that no ordinary mixtures or old seeds are supplied, and whether it be vegetable seeds for the garden, agricultural seeds for the farm, or flower seeds for prize-taking or decoration, the germinating power of all seeds is proved before being sent out; thus the disappointment so often experienced by seed failing to grow is entirely obviated.

Mr. William Bull will be happy to forward his illustrated catalogues of plants, seeds, and bulbs, in all of which, every article is priced.

The address of Mr. WM. BULL, F.L.S. is King's Road, Chelsea, London.



USUAL METHODS OF CULTIVATING FRUIT TREES.

The firm of Messrs. JAMES DICKSON & SONS, Newton Nurseries, Chester, established for very many years, and now with several branch Nurseries in Wales, seeing the change that is coming over trade and agricultural enterprise, and the exposition of the British Colonies, have laid themselves out to execute orders at low rates. A portion of their grounds are upwards of one thousand feet above sea level, and the plants consequently particularly hardy and vigorous, are specially suited to withstand a lengthened voyage.

It is interesting to examine their immense stock of some fifty millions of trees and plants of almost every stage and growth, and to notice the admirable system, which is carried out so rigorously, of transplanting a very large portion every year, so as to ensure great, indeed it may be said invariable success when they are disposed of, this regular and careful periodical removal, producing plants and trees with compact fibrous roots, and again the specimens are selected for export, sorted and specially prepared before packing them into the cases.

Those who are botanists, and others interested in the acclimatization of trees, will be glad to know that Messrs. JAMES DICKSON & SONS cultivate a great number of species and varieties, and it is questionable if there is an establishment, in any part of the globe, with such a varied and extensive collection.

Steam has brought our Colonies, with splendid climates, close enough to our shores to ensure forest and fruit trees, roses, vines, evergreens, and flowering shrubs being shipped in "The Christy Cases" and arriving in good order. Freights are nearly as low to the Colonies as between two of our own cities, so Colonists can depend upon receiving well-established and carefully-grown trees that will quickly form shelter from wind and sun, and rapidly grow into timber; fruit trees that will quickly produce crops of fruit of the best description, and ornamental shrubs, evergreens, and roses, for decoration of their gardens.

Farmers, as has been shown in these pages, must now lay down grass, and have sheltered fields and runs for stock, and landlords will doubtless assist them, in many instances, as they find it so much to their interest to improve their estates. Trees can be planted in spots hitherto barren. Space will not admit of debating further the advantages and inducements of getting supplies upon a commercial basis and with rapidity, and as the Newton Nurseries are now connected with the Railway Station at Chester, trees can be selected, packed, and despatched, without loss of time, and on the most advantageous terms, to the purchasers, for cash.

For shipment, trees best adapted for the particular purposes are judiciously selected, and the many years experience of the principals of the firm are at all times brought to bear in the interests of purchasers, who may therefore rely with every confidence upon their judgment.

Cases of fruit trees will be delivered in principal ports at £10 per case, and will consist of 50 selected—

Apples,	Figs,	Pears,
Apricots,	Nectarines,	Plums,
Cherries,	Peaches,	Vines,

and if desired selections of all or part can be sent, or of other miscellaneous trees, such as

Citron,	Lemon,	Walnut,
Orange,	Chestnut,	Eugenia,
Currants,	Goosberries,	Raspberries,

Citrons, Oranges and Lemons, which produce large returns to growers.

Cases of forest or timber trees at £6 per case, consisting of one hundred

Alder,	Beech,	Chestnut,	Oak,	Elm,
Ash,	Birch,	Poplar,	Sycamore,	Willow, &c.,

and if purchasers desire it, any of these can be reduced, omitted, changed, or increased.

Cases of roses at £10 per case, will consist of one hundred worked standards or dwarfs of the very best kinds of recent introduction, and best of the older varieties.

Cases of evergreen and deciduous shrubs at £10 per case, will consist of 50, varied to order.

Arbutus,	Dogwood,	Hibiscus,	Osmanthus,
Aucuba,	Daphne,	Hydrangea,	Prunus,
Berberis,	Euonymus,	Laurel,	Rhododendron,
Box,	Elder,	Lilac,	Sweet Bay,
Cytissus,	Guelldre Rose,	Laurestine,	Spiræa,
Cistus,	Eucalyptus,	Magnolia,	Weigelia, &c.
Deutzia,	Holly,		

Farm, vegetable, and flower garden seeds, of pure strains, can be forwarded in assorted collections to suit the requirements of purchasers, also bulbs and plants.

The laying down of land, with the best and most nutritious grasses and clovers, has for very many years specially received the most careful attention of JAMES DICKSON & SONS, also the production of the purest root crop seeds.

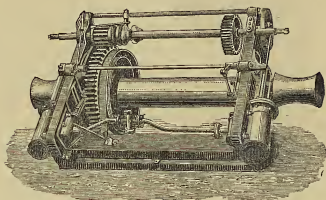
Messrs. JAMES DICKSON & SONS, publish annually carefully compiled descriptive catalogues of:—

Forest Trees,	Agricultural Seeds,
Vegetable and Flower Seeds,	Fruit Trees,
Florists' Flowers,	Hardy Ferns,
Hardy Ornamental Trees,	Flower Roots,
Spring Flowering Plants,	Herbaceous and Alpine Plants,
Stove and Greenhouse Plants,	Vines,
Strawberries,	Farm Implements and Machines,

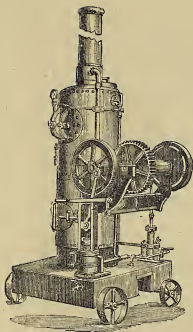
which will be forwarded without charge on application. Any one interested in agriculture or horticulture cannot do better than obtain copies.

LIFTING, PUMPING, AND PRESSING MACHINERY,

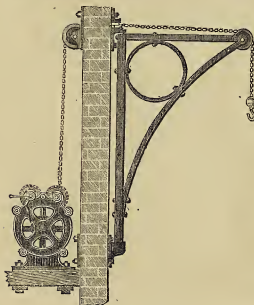
MANUFACTURED BY PRIESTMAN BROTHERS,
HOLDBERNESS FOUNDRY, HULL, AND 155, FENCHURCH STREET,
LONDON.



The great need now felt in all branches of industry for the best means of securing efficient lifting power has claimed considerable attention. Besides machinery of a more powerful kind, like that used in the lifting of locomotives, marine engines, &c., Messrs. PRIESTMAN BROTHERS found there was a growing need for less powerful apparatus suitable for hoisting, in the shape of steam cranes, winches, steam hoists, &c., and in the case of smaller power, warehouse cranes and hand winches are applicable; the latter are supplied with single and double-purchase motion. The above drawing represents an improved steam winch suitable for ships' deck, contractors, warehouses, &c. They are fitted with a pair of cylinders, reversing gear, double-purchase motion, powerful brake for lowering, and with all the necessary clutches, &c., and are under the easy control of one man. They are of ample strength and carefully and accurately fitted. Two handles are provided to enable them to be worked by hand power when steam is down.



The steam hoist shown by the accompanying drawing is especially applicable for Builders, effecting great saving in lifting bricks and mortar, &c., in the construction of high buildings, also for warehousemen in lifting sacks of grain, contractors and others requiring lifting power. By disconnecting the lifting gear which can be done without any trouble, it makes a very simple but useful engine for Farmers in chaff cutting, root pulping, or corn crushing, &c.; also for general purposes when a small amount of steam power is required, as in pumping, turning, and sawing.

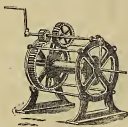


Perhaps one of the most universally adopted means for lifting small weights is the warehouse crane with crab as shown. The crab is supposed to be fixed to the floor of a warehouse, while the crane works in brackets fixed outside the wall. By placing the crane at the top of a warehouse, this arrangement will be found convenient for lifting packages, &c.,

and delivering them to any story in the building; for very light work these cranes could be used with rope or chain without crab, the advantage over the ordinary fixed beam being—that the crane when not in use, can be put back against the wall, thereby



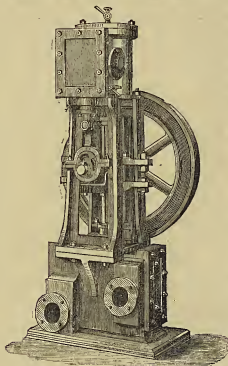
SINGLE-PURCHASE CRAB.



DOUBLE-PURCHASE CRAB.

avoiding obstruction to the roadway. The "Hand Crab" shown above is of a most simple and yet efficient make, and is suitable for a variety of lifting purposes, especially for builders, railway, and

other contractors; they are supplied with either single or double purchase motion and, with or without brake gear for lowering, the rope being attached to the barrel works through a sheave fixed in an elevated position, generally by means of a derrick or similar arrangement.



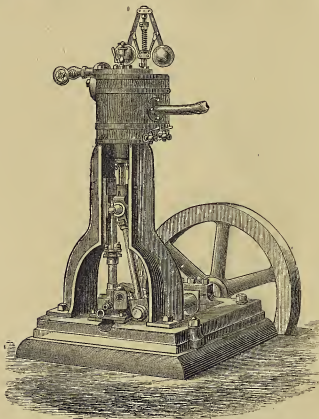
Another lifting power, universally required where steam is employed, is that of the donkey pump. This drawing represents a double acting pump, with inverted steam cylinder and powerful fly wheel; the plungers are of gun metal, and the pump is lined with copper; the whole forms a most useful



and superior pumping engine, the main features of which are strength and simplicity; this may be used for large land and marine boilers, in mines, and in any case where a large quantity of water is required to be lifted at a low cost.

For the same class of work on a smaller scale, the single acting pump, as shewn, of which a variety of sizes are made, is very economical.

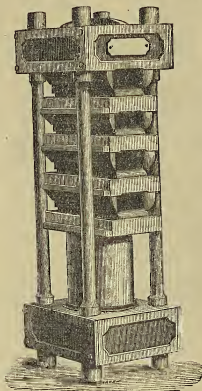
Amongst the large variety of engines now offered to the public suitable for stationary purposes, nothing is more complete and compact, of its kind, than



the Vertical Engine with inverted cylinder, as shown, which is applicable for a very large variety of purposes; it requires very

simple foundations, and, having but few working parts, it is not liable to get out of order.

PRIESTMAN BROTHERS are makers of a class of machinery



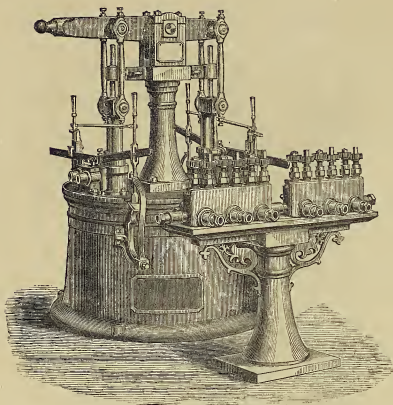
to which comparatively little attention has been paid, especially in the East, and that is for the extraction of oil from various kinds of seed, and the manufacture of cakes for cattle feeding and manure applied directly to the crop or plant. When referring to its use as a food for cattle, we must not omit to point out the great benefit which the manure is to the land when the cattle are fed from these cakes, and the relative values of which will be found on page 40 showing that oil-cake produces the highest results, and yet where oil-nuts abound, low-priced simple oil-mills have not as yet been introduced.

The accompanying drawing represents a small part of this

arrangement, in the shape of an improved Hydraulic Press, with loose steel cylinder, four wrought-iron columns, and cast-iron boxes, which latter contains the seed requiring to be pressed.

The presses are worked by hydraulic pumps, like those shown in next page, supplied with the stop-valves on a separate stand, as represented, so that all the presses can be worked together or separately, as required.

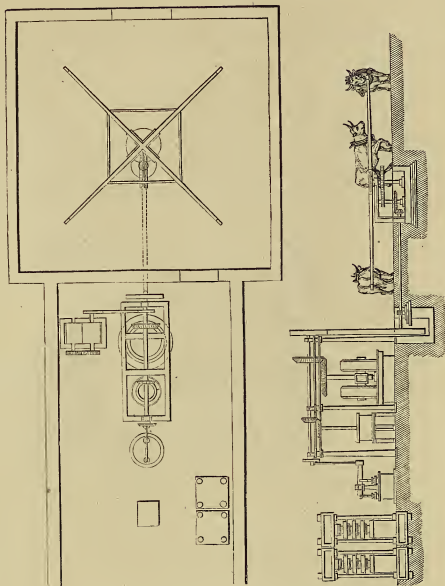
Besides presses and pumps, rollers, edgestones, and kettles are required, full particulars of which, with drawings, will be gladly supplied on application.



DESCRIPTION OF BULLOCK MILL.

For colonial purposes the mill shown on the next page is made to be worked by bullocks, and has been designed especially for foreign countries where steam-power is not to be obtained. One very great advantage is its simplicity, and being made in small parts it is very easily conveyed inland, over bad roads, and where it is difficult to obtain lifting power.

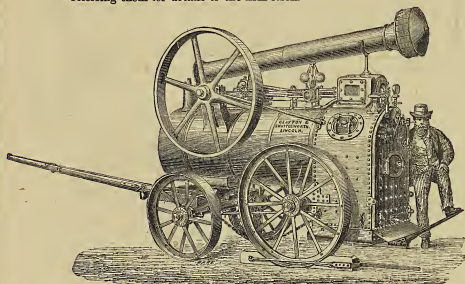
This mill includes driving gear with shafts and belting, two presses with 8 in. rams and four boxes to each press, one pair of edge-runners and rolls, 1 set of single pumps with stops, and kettle, with furnace attached; the whole being delivered in complete working order.



THE PORTABLE STEAM ENGINE.

The successful working of some of the machines mentioned in this book, and many others of like character, has been made possible, only, by the introduction of the Portable Steam Engine in a practical and economic form, a success for which Englishmen are indebted to the firm of MESSRS. CLAYTON & SHUTTLEWORTH.

We give an illustration of this engine, and append a few statistics of this manufacture for the information of our readers; referring them for details to the firm itself.



For instance, it may be mentioned that as many as sixteen thousand Steam Engines, of various powers, have been made by CLAYTON and SHUTTLEWORTH, which are successfully working in all parts of the world, and this establishment is now adapted for making four per day.

This industry affords employment to a great number of hands as well as to a vast number of machine tools—some of them

of the most ingenious construction, specially made for this particular work—and a visit to the works is a treat even to the uninitiated. The following is a list of the machinery made by CLAYTON and SHUTTLEWORTH, viz.:—Portable Steam Engines, made for burning Coals, Coke, Wood, Straw, &c., &c., and adapted for all countries. Stationary Engines, either erected on a boiler or with separate boiler; Traction Engines (or Road Locomotives), for drawing a load on a common road—also adapted for general work as portable Mills for Grinding Grain of all kinds, Cement, Pumice, &c.; Steam Thrashing Machinery for Grain and Seeds; Pumping and Hoisting Machinery; Circular Saws, and some other smaller matters.

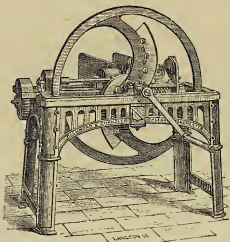
The chief manufactory is at Lincoln, and they have offices in London, at 78, Lombard Street; Exchange Buildings, Liverpool, Vienna, Pest, Prague, Bunn, Cracow, Lemberg, Czernowitz, Odessa, Rostoff, Bucharest, and other places.

Catalogues with list of prices free, containing full particulars and reduced prices, can be had upon application to their Works at Lincoln, or 78, Lombard Street, London.

THE CENTRAL AGENCY OF AGRICULTURISTS OF FRANCE

Has invented an ingenious and pretty little machine which indicates the proper kind of Chemical Manure, and the quantity suitable for various crops. This "Agriculturist's Compass," as it is termed, should become popular in England. It is supplied in Paris by the Agency (Messrs. Alfred Dudoüy & Cie., No. 38, Rue Notre Dame des Victoires) for 5 francs, and will give pleasure to anyone whom the subject interests, and who likes to receive instruction in a pleasant form.

The Agency's "Annual" for 1877, is a very neat and useful volume, giving all the experiments recently tried amongst French farmers, with their results, and explaining the table (*Tableau de la Comptabilité du Sol*), recently issued by Messrs. Dudoüy, which in a tabulated form gives all the latest information on the subject of Manures, and states the particular kind required to re-invigorate land impoverished by a certain crop. I shall be glad to procure these for any of my readers, who will be much interested in comparing the methods used in France with those familiar to us in England.



GREEN FODDER OR CHAFF CUTTERS.

It is so important to secure a machine that will not cause disappointment, as this process of cutting on the various green crops, as explained in our article on this subject, must be done rapidly, and the tanks filled quickly with wet or dry fodder in a green state. Messrs. RICHMOND & CHANDLER, of Salford, near Manchester, have studied this question, and allow me to use their name. Having for Chaff Cutters taken the Prize of the Royal Agricultural Society of England, at every competition since 1854, they are unquestionably the best machines made for cutting green food. Several sizes can be fitted with self-acting endless webs or bands, working along the bottom of feed boxes and carrying the green material forward to the feed rollers. All who have used machines, especially for cutting this green food, will at once realize the value of this invention, as they know the difficulty which has hitherto existed in feeding machines with this material, and they can also understand that by means of the self-acting web, this difficulty is entirely overcome.

They also fit these machines with horse-power and supply corn crushers, steam apparatus, &c. They will supply full particulars and prices upon application to the Works.

The WELLAND VALE MANUFACTURING COMPANY, of St. Catharines, Ontario, Canada, have obtained a high repute for the excellence of their Agricultural Implements. At the Provincial Exhibition of 1874, they were awarded first prizes for their Hay and Manure Forks, Seythes and Hoes. They have invented and patented a different style of prong for their forks, and an improved cap ferrule, with or without straps, for the handles of their Forks, Hoes, &c.



The improvement consists of a WROUGHT COMPRESSED CAPPED FERRULE, all made in one piece, with a thick and handsomely rounded shoulder of very great strength, which fits close round the neck of the tang and over the end of the handle, giving the latter an unyielding grip of the instrument with its whole strength and close up to its working part, thus making this the strongest point of the tool, and overcoming the objections found in the ordinary Sockets and Ferrules in general use. These Ferrules will not allow the Forks to become loose, and are acknowledged to be of very superior strength and durability, besides presenting a remarkably neat and finished appearance.

For all kinds of Forks the patent "Balloon Tine" possesses great advantages over the round and oval prong, and has become very popular with those who have once tried it. Its superiority is obvious. It is *round* on the upper or bearing part of the prong, which gives it the proverbial easy delivery of the round prong, while it has the *depth or acute* form of the oval prong on the under side, which gives it the superior lifting strength or stiffness of the oval prong. The "Balloon Tine" Fork has its name because a cross-section of the prong resembles the outline of a balloon.

All information can be obtained from, and orders received at, the offices of the Company, at Liverpool, or at 155 Fenchurch Street, London. The goods are packed in cases at the Works, and sent over carriage free to Liverpool, or delivered direct from Canada to any part of the world by special arrangement. Prices will be found lower than any others, while the quality and workmanship of the goods are very superior.

One of the first necessities on all Estates, both at Home and in the Colonies is to obtain tools on which a perfect reliance for quality may be placed, and at a reasonable price. And with an able proprietor, it is astonishing what a variety of work can be turned out, if the necessity for so doing arises. Colonel Chichester, of Runnamoat, in the west of Ireland, designed and constructed the whole of his farm buildings, covering some acres of ground, without employing or paying for any skilled labour. His own farming men, working under

his guidance, took the place of professional carpenters and other skilled artisans, which could not have been found nearer than twelve miles. This plan might be carried out very much more frequently than it is at present. Articles bought in the nearest town are often inferior in quality and cost very dear. Mr. Richard Thomas, of the Icknield Works, Birmingham, has given me permission to use his name. It is a great convenience to be able to treat direct with a large manufacturer. His wedge-shaped axes for felling trees are made by new and improved machinery, giving a wonderful uniformity in their manufacture. Cultivating tools, picks and pickaxes of all descriptions, mattocks for rough ground and roots, garden tools of every variety, including a special tool for transplanting young trees and shrubs. All kinds of carpenters and bricklayers tools are made at these works, and great attention paid to the tempering of them. Enquiries or Orders sent to the Icknield Edge Tool Works, Birmingham, will receive every attention.

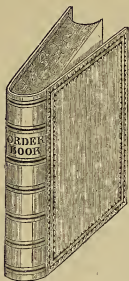


CONVEYANCE OF STOCK BETWEEN ENGLAND, THE CONTINENT, AND THE COLONIES.

The frequency of Exhibitions, and the importance to farmers of showing prize stock on the Continent, proved the necessity of establishing some competent Agent, who would undertake the whole routine, and, so far, Messrs. Sollas & Sons have been most fortunate in delivering, in good condition and to time, the valuable stock entrusted to them.

The competition among Carriers, especially those connected with the Continent, led to the practice of tampering with Foreign Customs in the declarations and values, much to the prejudice of the owners of the goods. When the well-known firm of Lebeau & Co. retired from business, several most important firms promised their support to their London Manager, Mr. Sollas, who thereupon opened a House as Sollas & Sons, at 74, Coleman Street, London, at 284, Passage du Désir, Paris, and at 7, Rue d'Argent, Lyons. Messrs. Sollas have special rates and arrangements, and give their personal supervision to the transport of Agricultural Engines and Machines, Implements and Grain.

Contracts are made with noblemen and farmers for the conveyance of Prize Stock, destined for exhibition at Continental shows, taken from the country, insured, and returned or disposed of, as may be desired, without any trouble to the owners. Goods and private effects may be consigned to "order of SOLLAS & Sons," from any part of the world, and will be warehoused or forwarded as instructed. If possible, it is advisable before despatching goods, *via* Europe, to write and consult with Messrs. Sollas & Sons to ascertain what route they recommend. This is especially necessary in cases where families are removing from one country to another. Contracts can be made to clear out a domicile, pack and remove the goods, and insure and replace them in a new abode, for a fixed sum without extra charge of any kind.



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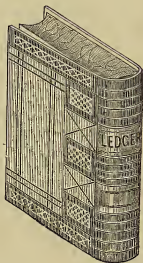
146, FENCHURCH STREET, LONDON, E.C.

Steam Printing Works :

14, CULLUM STREET, E.C.



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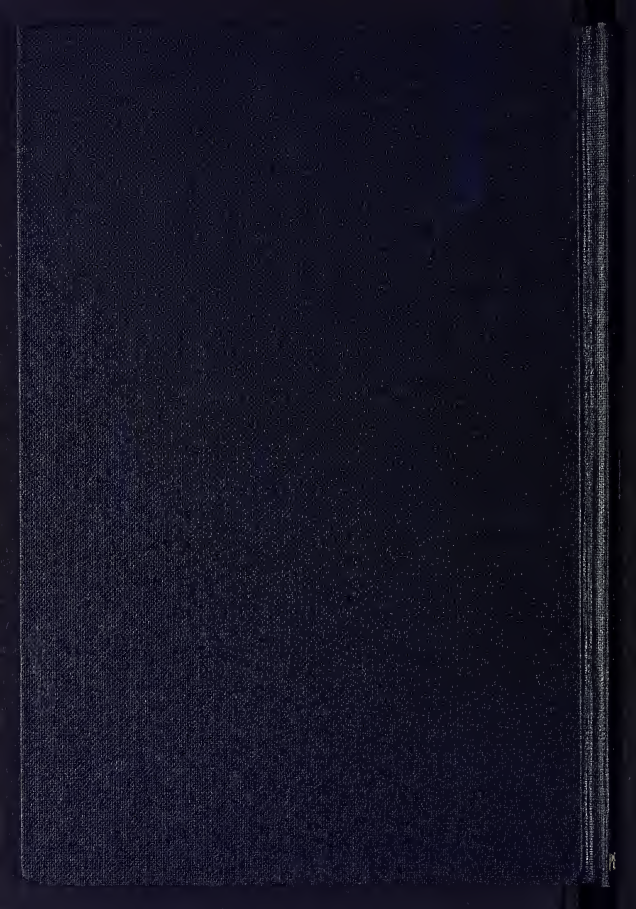




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